

# CANADIAN MACHINERY

## AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.

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\$3.00 per Year



**SKF**

16 No 4

### HANGERS

Save 15 to 33% power  
Cut lubrication 80%  
INVESTIGATE

CANADIAN **SKF** COMPANY LIMITED

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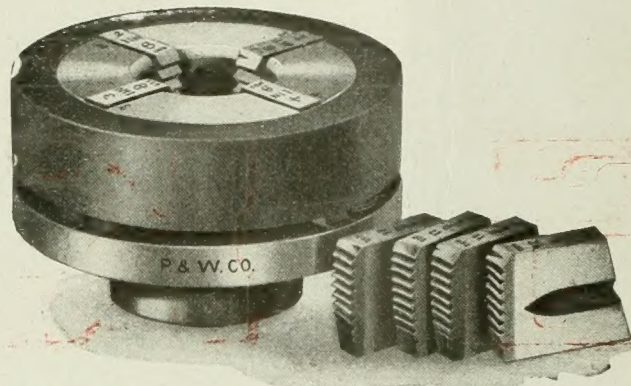


CANADIAN MACHINERY

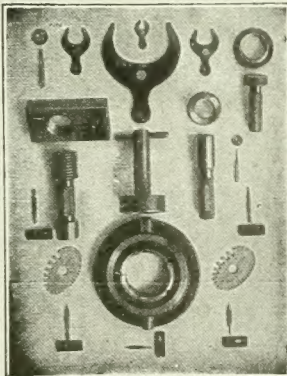
# SMALL TOOLS

## PROMPT SERVICE

is assured at our nearest store where P. & W. Small Tools are carried in stock. Place your order there to-day.



## P. & W. Die-Stock Dies



PRATT & WHITNEY  
Standards and Gauges  
Accuracy Unequaled

These dies are practically solid when in use and can be adjusted 1-32 in. larger or smaller. The chasers can be quickly removed for the purpose of renewal or sharpening. Standard sizes furnished include U. S. Standard, Whitworth Standard, S. A. E. Standard and "V" form, all right hand; also special right-hand Briggs Standard taper pipe thread.

The Pratt & Whitney policy of highest quality materials, together with the necessary refinement and accuracy, is maintained.

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WINNIPEG  
1205 McArthur Bldg.

VANCOUVER  
B.C. Equipment Co.

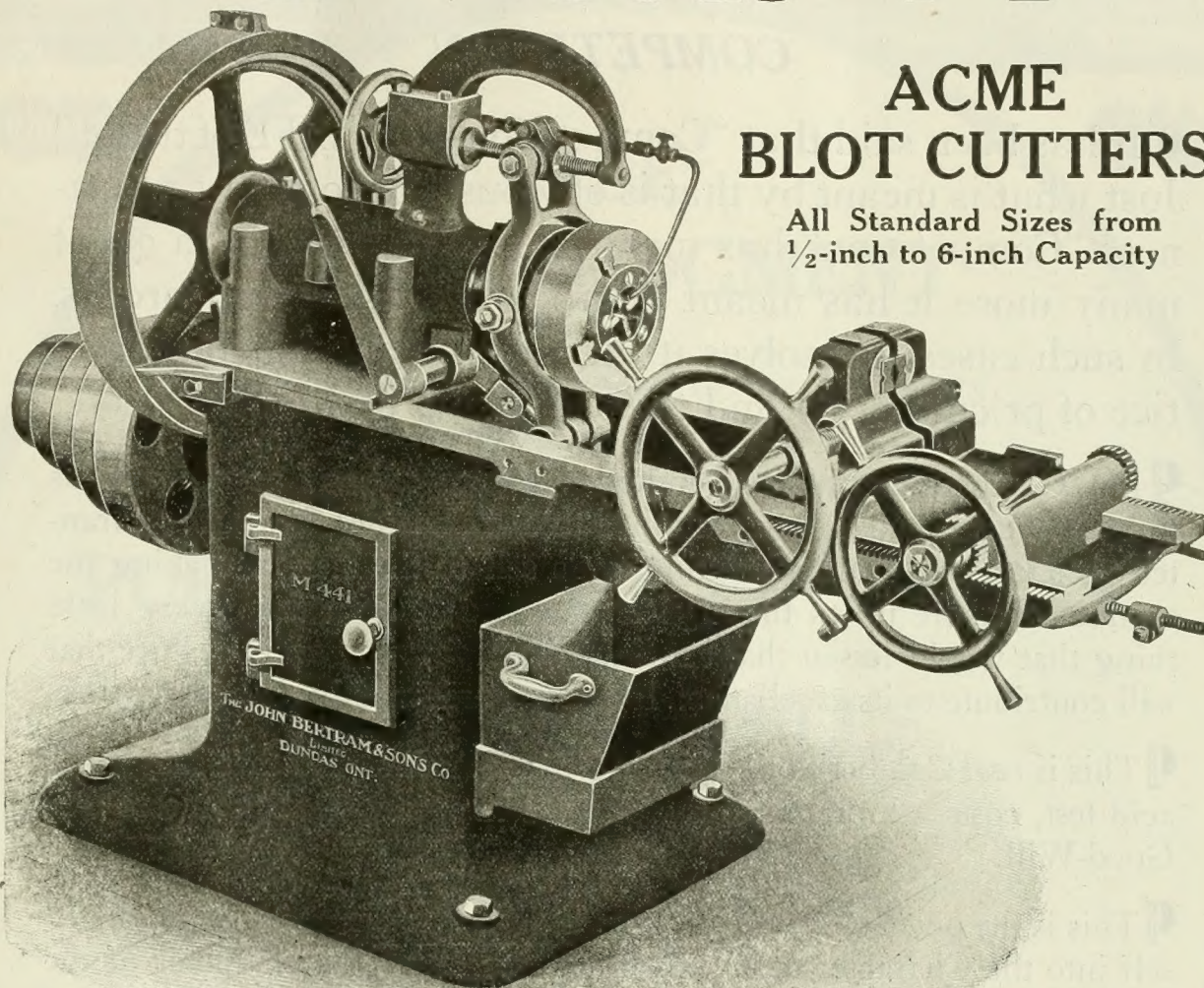




# BERTRAM MACHINE TOOLS

## ACME BLOT CUTTERS

All Standard Sizes from  
 $\frac{1}{2}$ -inch to 6-inch Capacity



Supplied with Leadscrew Attachment for Stay Bolts or other work requiring special Accuracy of Pitch.

WRITE US FOR FULL DETAILS ON ANY MACHINE  
OR MACHINES IN WHICH YOU ARE INTERESTED

## The John Bertram & Sons Company Limited

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# The Publisher's Page

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TORONTO MARCH 20, 1919

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## COMPETITION

¶ It has been said that "Competition is the LIFE of trade." Just what is meant by that is obvious; but to many a business "Competition" has meant death to trade; to a great many more it has meant death to well-deserved profits. In such cases it resolves itself into the abominable practice of price-cutting and the sacrificing of quality.

¶ But, Competition can be so understood, accepted and acted upon, as to be an ideal, which when applied to one's business is a sure guarantee of "success." It means setting one's self to the task of making the product measure up to the highest standard; eliminating every little thing that would lessen that standard, incorporating every feature that will contribute to its excellence. In other words, making a *better* article.

¶ This is *real* Competition—the kind that rings right, that stands the acid test, costs a little more, is worth a little more, that promotes *real* Good-Will.

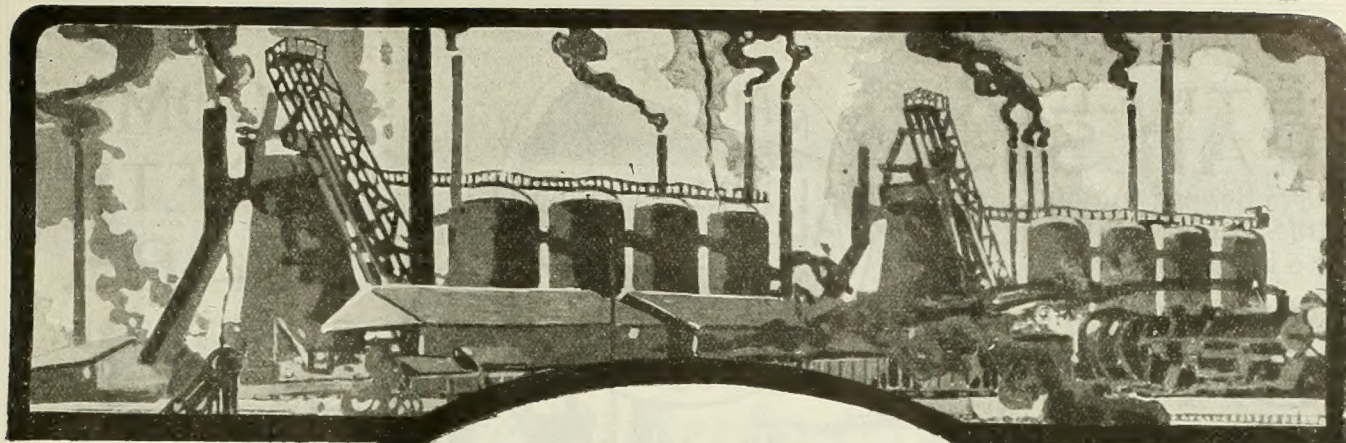
¶ This is the one true spirit of Competition—the feature that works itself into the Character of the manufacturer, into the character of the employee; into the finished product in such a way as to establish that substantial renown which will insure for it a lasting market.

*Ten minutes more time spent on a certain product in the finishing room of a well-known factory guaranteed the sale of three times as many of a similar article put on the market by a rival concern.*

*Of course, this high quality product was a well advertised line of goods.*

*"Success or failure are not chosen for us; we choose them for ourselves."—Mabie.*





**Quality**

**Service**

**USE  
GOOD JUDGMENT**

And contribute your share to the prosperity  
of the Country in which you live.  
Spend your money where you earn it.

**PURCHASE THE PRODUCTS  
OF  
CANADIAN MILLS**

A Canadian Dollar  
is Worth One Hundred Cents  
in Canada

**THE  
STEEL COMPANY  
OF  
CANADA  
LIMITED**

**HAMILTON**

▪     ▪

**MONTREAL**



# STEEL RAILS

Open Hearth Quality  
(All Sections from 12lbs  
to 100lbs per yard)

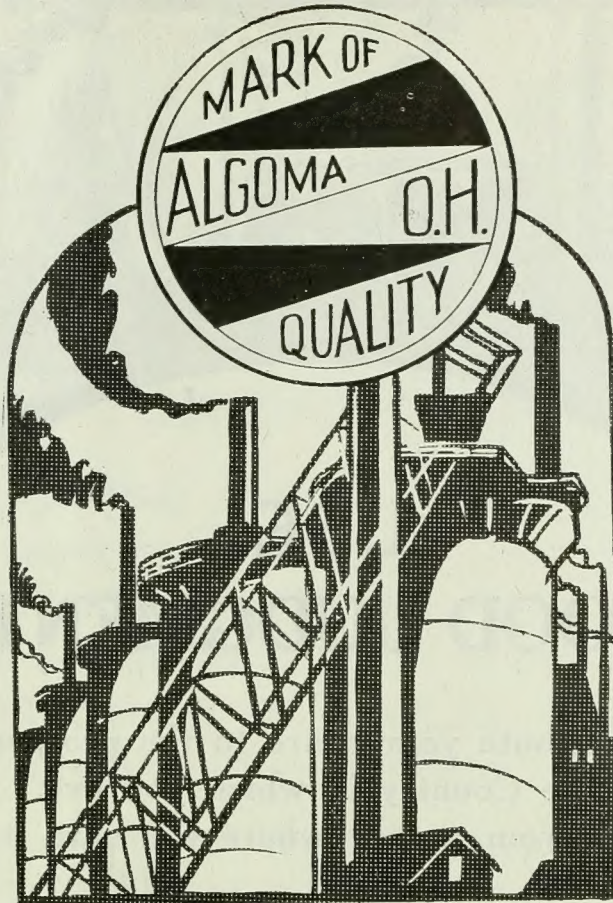
# SPLICE BARS

# STEEL TIE PLATES

# PIG IRON

BASIC, FOUNDRY-  
BESSEMER

# SULPHATE OF AMMONIA



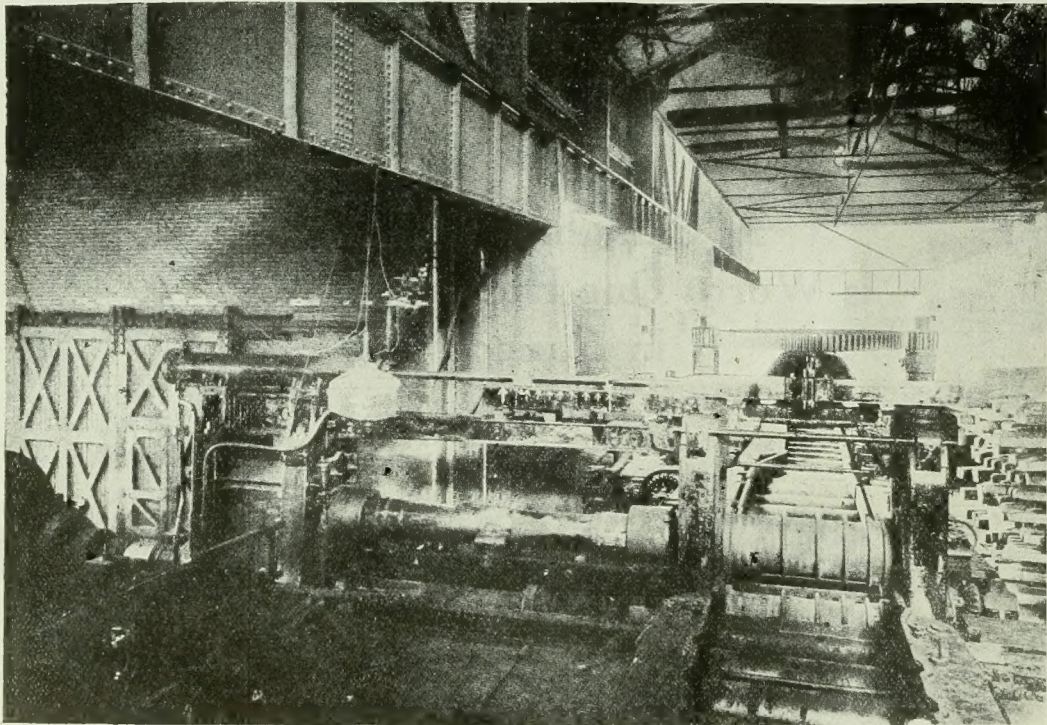
# BLOOMS, BILLETS, SLABS, STRUCTURAL STEEL MERCHANT BARS

# CONCRETE REINFORCING BARS

# IRON, BRASS AND BRONZE CASTINGS

*Sulphuric Acid.*

*Nitre Cake.*

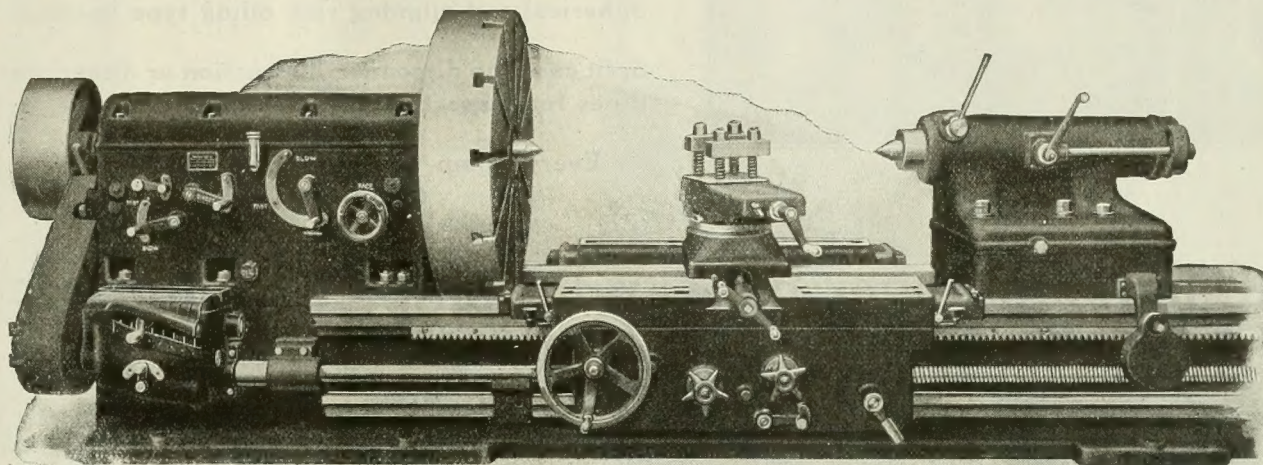


**ALGOMA STEEL CORPORATION, LIMITED**  
SAULT STE. MARIE, ONTARIO



# BRIDGEFORD

*Many of the World's Largest Industrial Plants are Bridgeford Equipped*



*A Few Bridgeford Equipped Plants*

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Carnegie Steel Co.  
Midvale Steel Co.  
Pennsylvania Steel Co.  
Cambria Steel Co.  
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Timken Detroit Axle Co.  
American Bridge Co.  
Packard Motor Car Co.  
Pierce Arrow Motor Car Co.  
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Standard Oil Co.

What better endorsement of quality and reliability could be obtained than the fact that many of the world's largest industrial plants are Bridgeford equipped?

Let the judgment of "big business builders" guide you in the selection of lathes.

Listed at the side are a number of representative plants using Bridgeford equipment—convincing evidence of the popularity and reliability of Bridgeford Heavy Duty Lathes.

The Bridgeford Line of Lathes includes Heavy Duty Geared Head Engine Lathes from 24-in. to 72-in. swing, Cone Driven Engine Lathes, Axle and Journal Truing Lathes and Manufacturing Lathes of 27-in. and 30-in. swing.

*There's a Bridgeford for every heavy duty lathe requirement. Write or wire for details showing how Bridgeford Lathes increase production and cut costs. We are in a position to make prompt deliveries.*

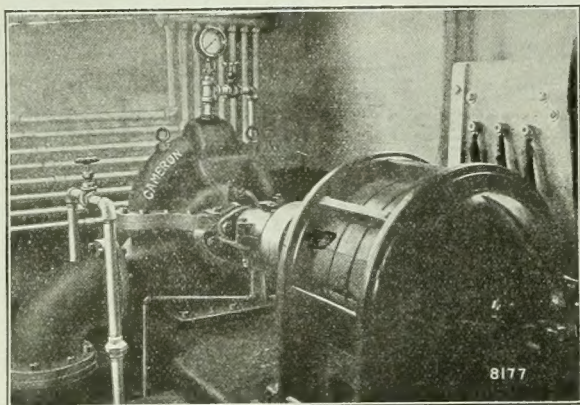
**Bridgeford Machine Tool Works**

151 Winton Road,  
Rochester, N.Y., U.S.A.

*Manufacturers of Heavy Duty Lathes for more than 20 years*



## The Cameron Double Suction Centrifugal Pump



Bulletin 7150

Did you read about "Old Man Specific" in CANADIAN MACHINERY for Feb. 27?

Here are some SPECIFIC facts about the Cameron "DV" centrifugal pump :

Spherical self-aligning ring oiling type bearing.

Split case; no disconnecting suction or discharge pipes for inspection and cleaning.

Every pump tested UNDER WORKING CONDITIONS.

## Canadian Ingersoll-Rand Company Limited

Sydney

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Cobalt

## Electrite

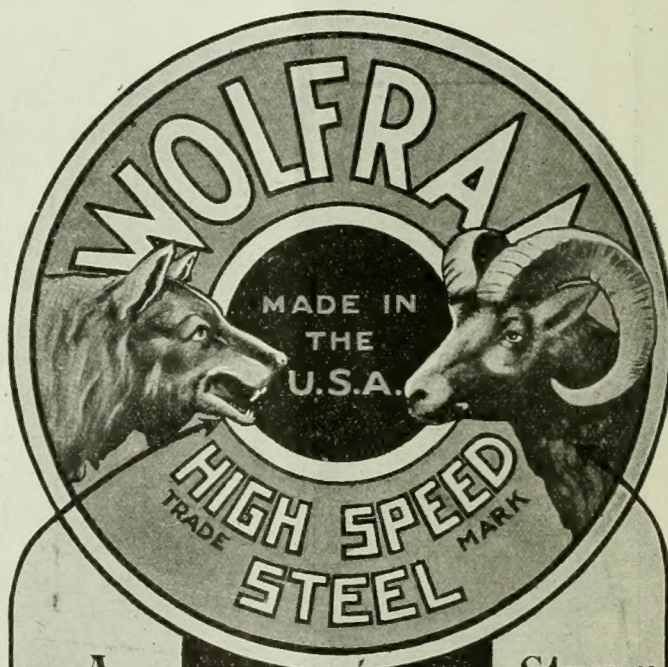
Electric furnaces, automatically regulated, the most modern methods, and the introduction of Uranium — make this a steel of truly remarkable cutting properties.

We know "Electrite" cannot be bettered — and stand ready to prove it to you.

LATROBE  
ELECTRIC STEEL CO.  
LATROBE, PA.

## High Speed Steel

## Uranium



A  
Keen  
Cutter

**WOLFRAM**  
*Is Both*

VULCAN CRUCIBLE STEEL CO.  
ESTABLISHED 1900  
Aliquippa Pa. U.S.A.  
Represented in Canada by Messrs Norlon  
Callard & Company Que.  
MONTREAL

Strong  
in the  
Neck



# WILT

**Progressive Manufacturers use Wilt Drills because**

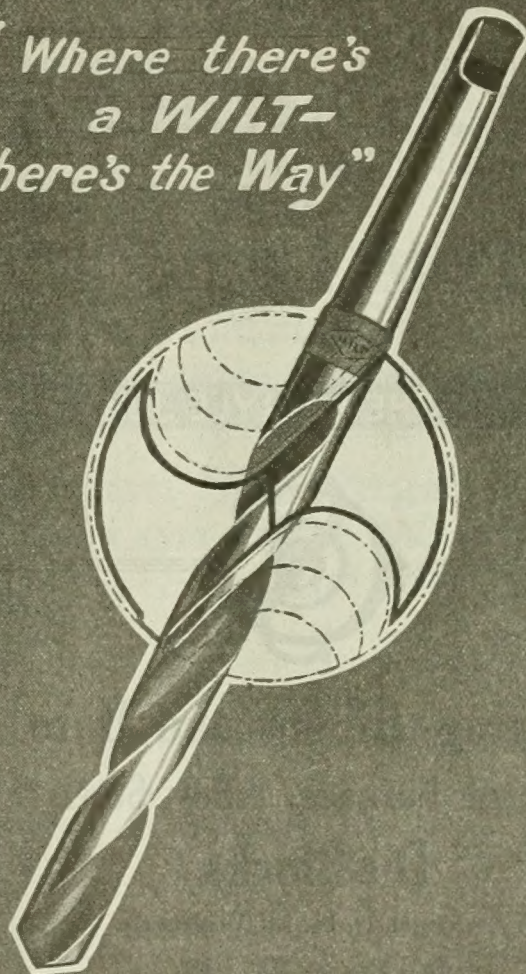
—THEY ARE DRILLS OF QUALITY made by specially trained high-class workmen, skilled in the art of drill manufacture.

—THEY REPRESENT QUALITY THROUGH AND THROUGH. Raw materials are selected with particular care, and only those materials that pass the most exacting inspection, based on the highest standards, are used.

—THEY ARE EFFICIENT AND ECONOMICAL. Their quality promotes long life under severest service, and the speed and accuracy with which they can be driven cuts the cost of production.

**A trial order will prove their merits.**

*"Where there's  
a WILT—  
there's the Way"*



**HIGH SPEED  
AND CARBON  
TWIST DRILLS**

**WILT TWIST DRILL CO.**

**WALKERVILLE**

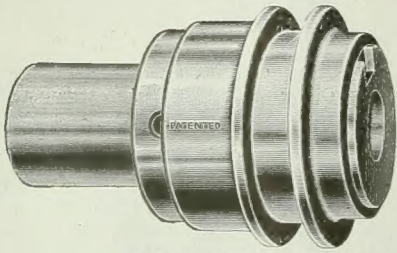
**OF CANADA, LIMITED**

**ONTARIO**

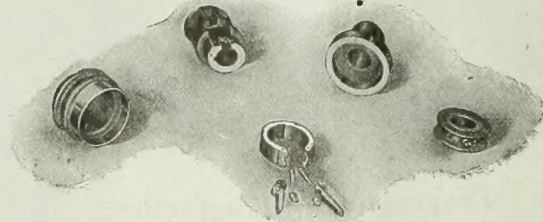
London Office: Wilt Twist Drill Agency, Moorgate Hall, Finsbury Pavement, London, E.C. 2, England



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SINGLE CLUTCH—EXTERIOR



## HAS FEW PARTS

each being interchangeable. Did you ever see a clutch with so few parts? The Johnson friction clutch is simple, small, compact, round, smooth and powerful. It is the clutch you have been looking for. For the overhead shafting, line shafts or countershafts it gives perfect satisfaction. As a part of the various machine tools on the market it is an important actor. Study the construction of the Johnson Friction Clutch. What are your requirements? Get our booklet, "Clutches as Applied in Machine Building." It shows what the other fellow is doing. Also

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**General Steel Company**

Milwaukee, Wisconsin

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Frogs, Switches  
Mates. Crosses  
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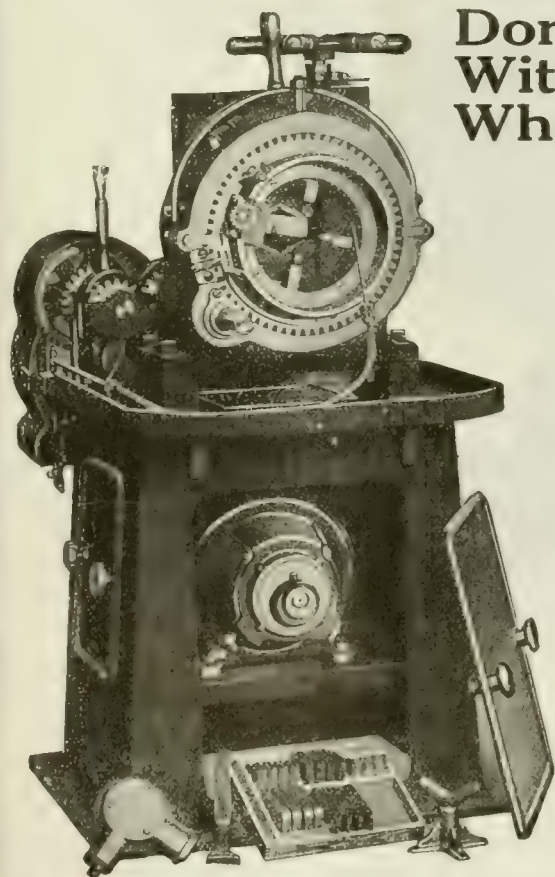
*For Steam  
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Railways.*

Built-up, Hard-  
Centre or Solid  
Manganese-Steel

# TRACKWORK

## COMPLETE INTERSECTIONS

**CANADIAN STEEL FOUNDRIES, LIMITED**  
Transportation Building, Montreal



### Don't Talk Man Shortage With Six Men on Pipe Work Where There Should be One

Don't let urgent work lag for the want of men while you employ a gang of men instead of one man and a

**Forbes Pipe Cutting and Threading Machine**  
on your pipe work.

The old-style stock and die method of cutting off 15-in. pipe required six men. It can now be done with one man and a Forbes Machine.

The motor-driven type follows the pipe-fitting work wherever an electric wire can be run. No hauling of heavy pipe to and from a stationary machine.

In the Forbes Machine the dies revolve. The pipe remains fixed in the self-centering vise. And the threads cut! They're the kind that make tight joints, because they're clean, accurate.

Write to-day for our catalog.

**The Curtis & Curtis Co.**  
115 Garden Street      Bridgeport, Conn.





The Ford-Smith Machine Company



# FORD-SMITH MILLERS

THIS MACHINE IS STRONG, RIGID, AND WELL BALANCED IN DESIGN. EVERY STEP IN ITS MANUFACTURE AIMS AT RAPID AND ACCURATE PRODUCTION.

## 4 SIZES

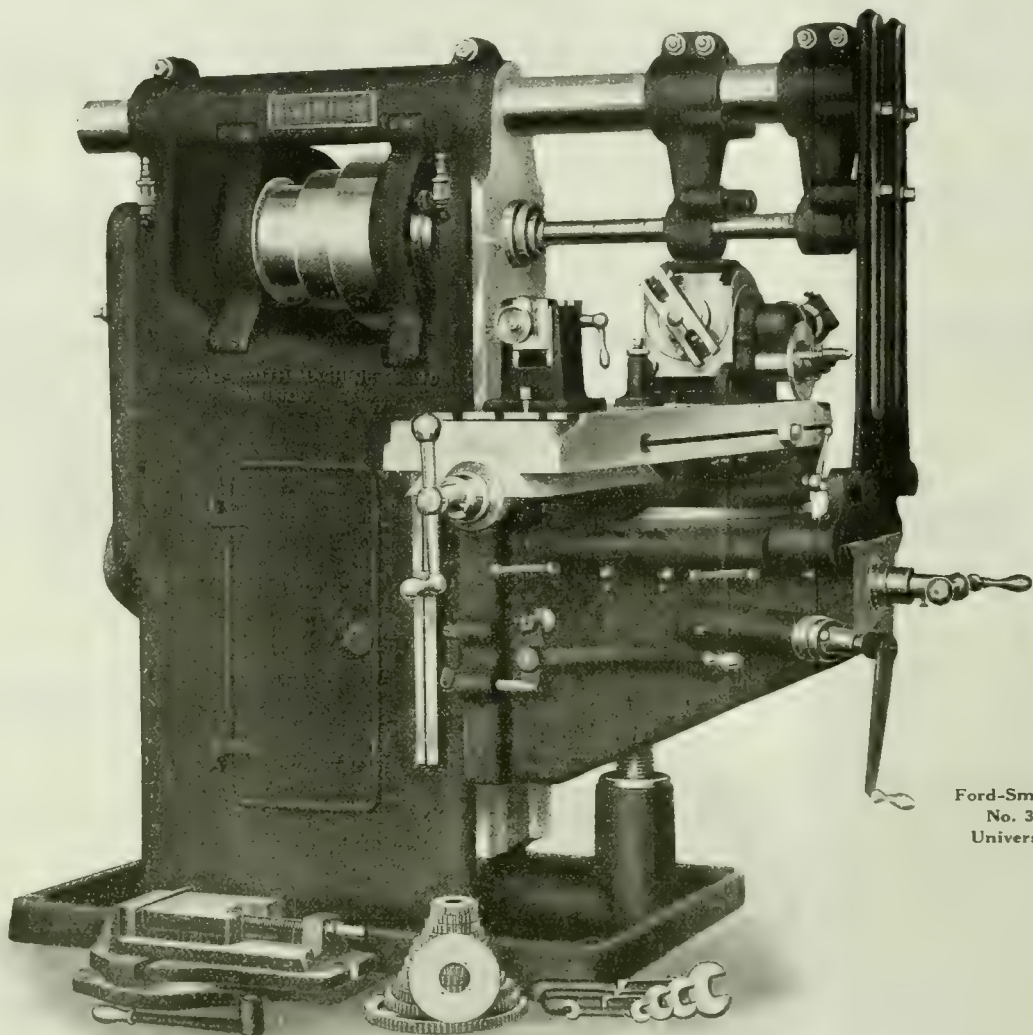
No. 2  
Plain  
24" x 19" x 7½"

No. 2  
Universal  
25" x 17" x 8"

No. 3  
Plain  
34" x 20" x 10"

No. 3  
Universal  
30" x 19" x 10"

ASK US TO SEND CATALOGUE CONTAINING FULL INFORMATION



Ford-Smith  
No. 3  
Universal

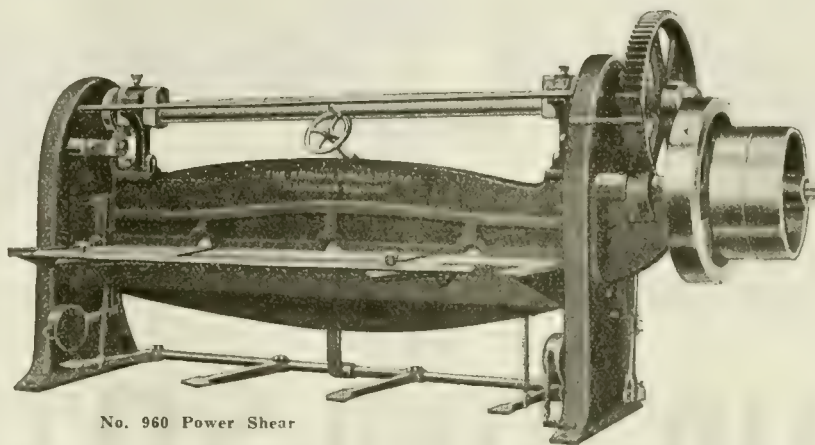
MANUFACTURED BY  
THE FORD-SMITH MACHINE COMPANY, LIMITED  
HAMILTON, CANADA

Foreign Agents: W. E. Storey, 3, Arundel St., London, Eng. Alfred  
Herbert, Limited, 54 Dey St., New York, United States, America.

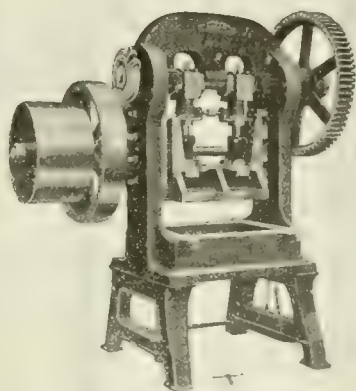




# Stood The Test



No. 960 Power Shear



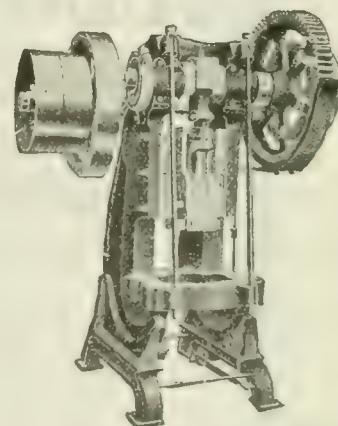
No. 201 1/2 Power Press

"B.B." Tools during the last four years have proven their superiority under the most trying conditions.

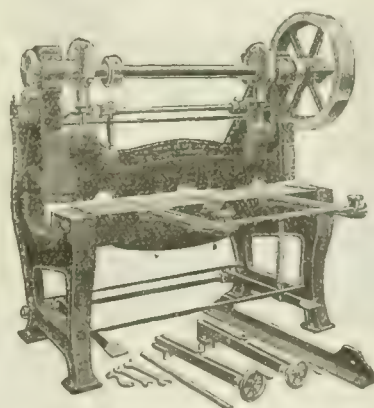
Inexperienced help and 24 hours' daily service will test the best machines.

Quality that is "*built in*" on a machine is bound to assert itself under such circumstances.

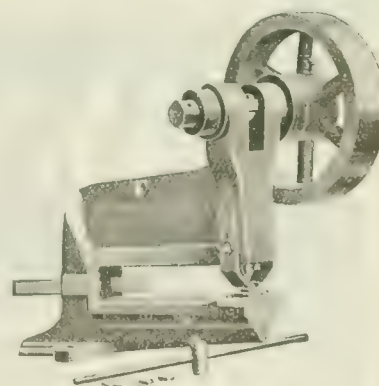
Our line comprises shears of all kinds, power presses for punching, forming, embossing, blanking, etc. Tin-smith's tools and sheet metal working machines of every description, also canners' and evaporators' machinery.



No. 215 Power Press



No. 401 Shear



No. 100 Power Punch



The Brown-Boggs Co., Limited

Hamilton, Canada





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## KE

### BRANDS OF ALLOY & TOOL STEELS

In Billets, Bars, Sheets, Hot and  
Cold Rolled Strips, Cold Drawn  
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Montreal Warehouse

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Agent

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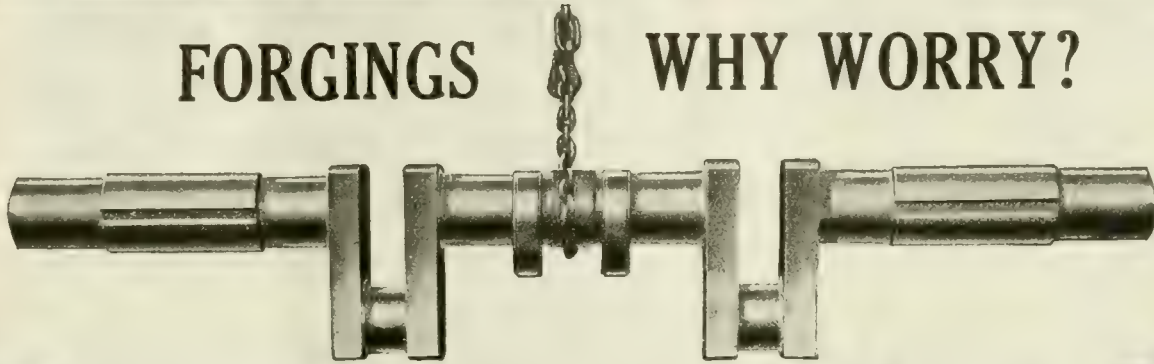
Montreal, Que.



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*Bring It To Us*

**Canadian Billing & Spencer Plant**  
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**Crucible**  
*AND*  
**Open Hearth Steel**  
  
**Tool Steel**

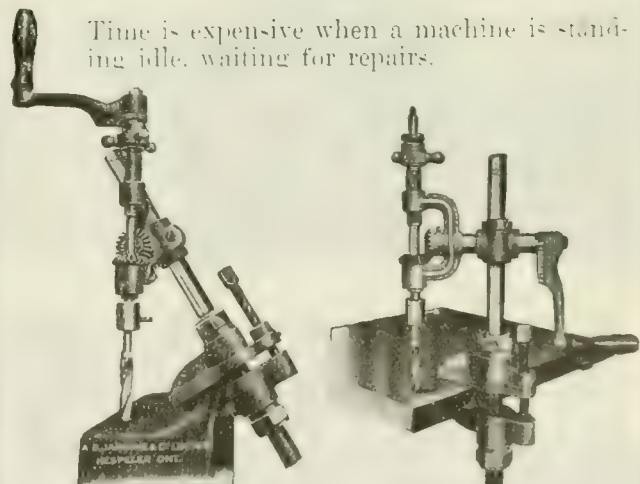
**"ARGO" BRAND HIGH-SPEED STEEL**

**The John Illingworth Steel Co.**  
1856

**Frankford, Phila.**  
**New York Office 217 Broadway**

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## Jardine Universal Ratchet Drill



Time is expensive when a machine is standing idle, waiting for repairs.

On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, \$26.50 net  
Sold by all Machinery and Supply Houses

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HESPELER, ONTARIO



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TRADE MARK



TRADE MARK



## High Speed Steel

"Double Waco" Quality—for  
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"Turtle Brand"—High-class  
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FOUNDRY &amp; MALLEABLE

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*The Ideal Steel for Machining Shells*

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*"Not Steel but its Master"*

The Progressive Mfg. Co., Ltd.  
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Gentlemen:-

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During the war, although our capacity was taxed to the limit in supplying STELLITE to Great Britain and France, as well as helping to keep Canada in the forefront as a producer of Munitions, we did not raise our prices, notwithstanding the fact that our costs increased enormously and are still up.

Let us help you to economize and at the same time secure maximum results.

Consult our Engineering Department.

We are, Sirs,

Yours respectfully,

DELOORO SMELTING & REFINING CO., LTD.

## Deloro Smelting & Refining Company, Limited

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MONTREAL  
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**W**AR is destructive. Peace is constructive. War has taught us many things, chief of which is the great value of Time. Time is the essence of your life and mine. Whatever saves Time, saves Life.

## "Red Cut Superior"

The Nationally Known **FIRST QUALITY**

### HIGH SPEED STEEL

Is the avowed Enemy of Waste and Inefficiency, and allied with Life. Save Time, Save Life

Are your Tools made of **Red Cut**?

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Direct representatives of foremost Swedish mills: makers of

### Tool Steels

ALLOY STEELS, BILLETS, BARS, DISCS, SHEETS, HIGH SPEED STEELS, DRILL RODS, DRAWN BARS, SEAMLESS TUBING, COLD ROLLED STRIP STEEL, WELDING WIRE, WROUGHT AND ROLLED IRON, PIG IRON, STEEL AND IRON ENDS, HOLLOW AND SOLID MINING DRILL STEEL.



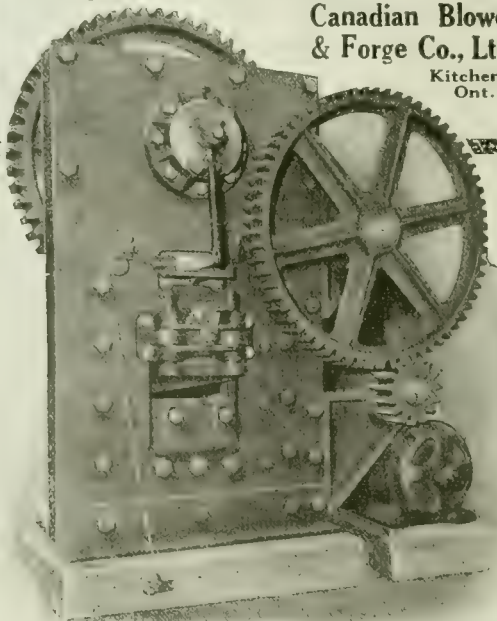
PROMPT SHIPMENTS  
from large stock

## CANADIAN ARMOR PLATE

PUNCHES, SLITTING SHEARS, and BAR CUTTERS are dependable. They are built of "Armor Plate" steel—tensile strength 75000 lbs. per square inch—7½ times as strong as cast iron.

That means a lighter and stronger machine—a machine built to take a lot of punishment. Write for Catalog P S-16

Canadian Blower  
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Kitchener  
Ont.





# Nova Scotia Steel & Coal Company

*Limited*

**New Glasgow, Nova Scotia, Canada**



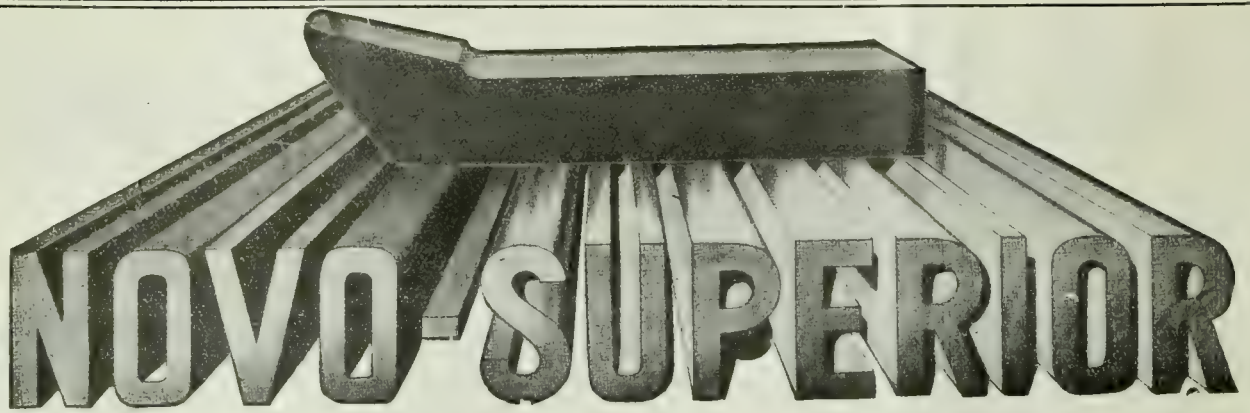
THREE AND ONE-HALF AND FIVE-TON "FLUID COMPRESSED" STEEL INGOTS.

The Nova Scotia Steel & Coal Co., realizing the importance of "fluid compression" as a valuable aid in producing reliable and first-class steel products, procured by purchase the Canadian license from M. Harmet, of St. Etienne, France, whereby they own the sole rights in this Country to use his process. This they considered in accordance with their policy of taking advantage of every important metallurgical development, thus advancing with modern progress, and particularly that their high reputation as manufacturers of the best marine, railway and machine forgings obtainable should be maintained.

The "fluid compression" plant laid down at Sydney Mines, N.S., consists of one group of four Harmet presses, each of 1,250 tons and capacity to handle  $3\frac{1}{2}$  to 5-ton ingots; and one of 4,000 tons to handle ingots up to 30 tons.

The product of this process is used in the manufacture of high-grade forgings, such as locomotive axles, crank shafts, marine forgings, artillery tubes and armor plate of the highest grade: in fact for all commodities in which maximum reliability and homogeneity of structure enter and are demanded.





**HIGH SPEED STEEL**

**INTRA STEEL**

**GIBRALTAR STEEL**

***Tool Steel for Every Purpose***

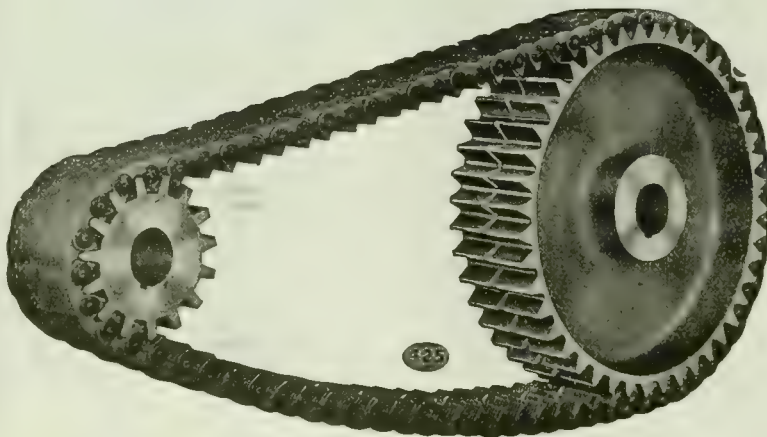
Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.,  
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Cold Rolled Mild Steel for Shafting, Etc.

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**Circular Saws**—for wood and for hot or cold metal cutting

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Patent Silent and Bush Roller Chains

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Chain Drives from ¼ H.P. to 5000 H.P. in successful  
operation

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**IMPERIAL GENUINE BABBITT METAL** *The Highest Grade  
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# MORSE DRIVES

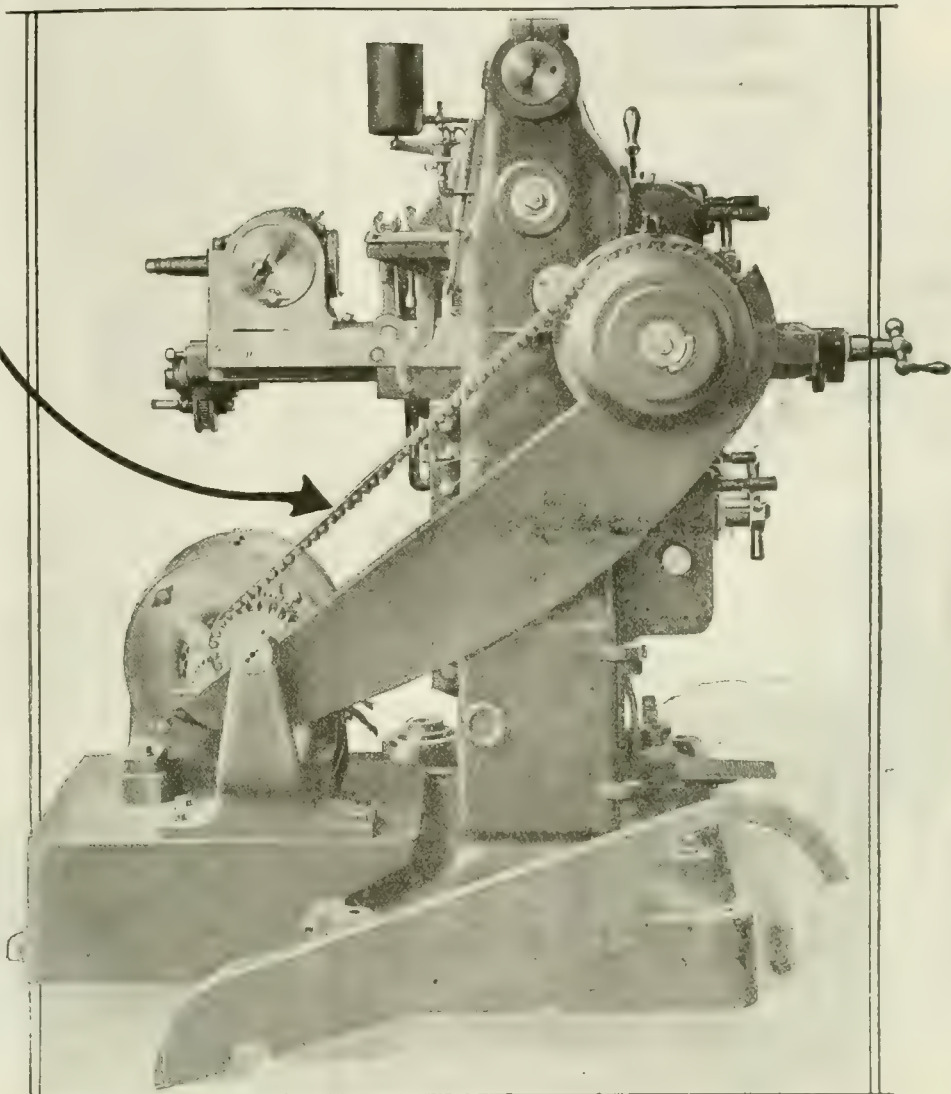


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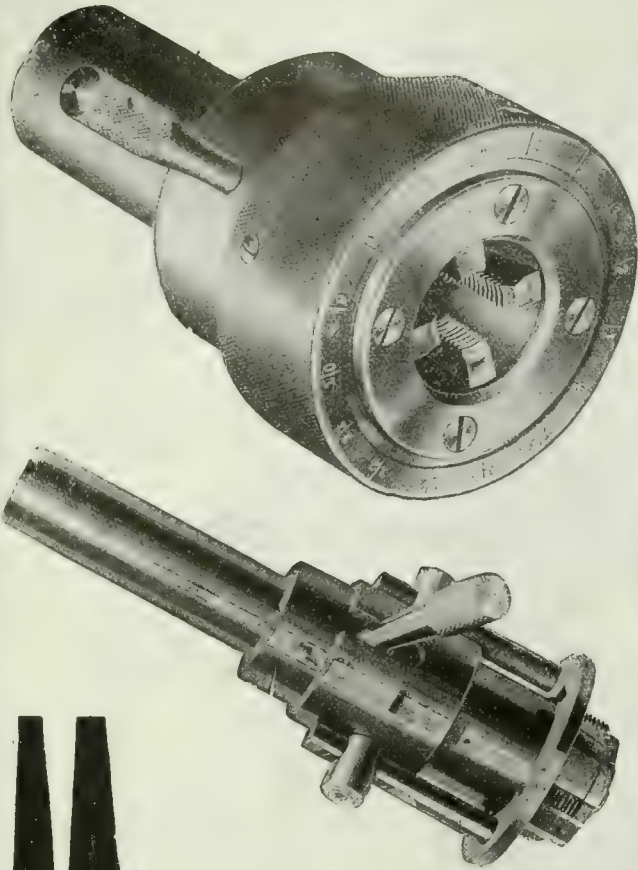
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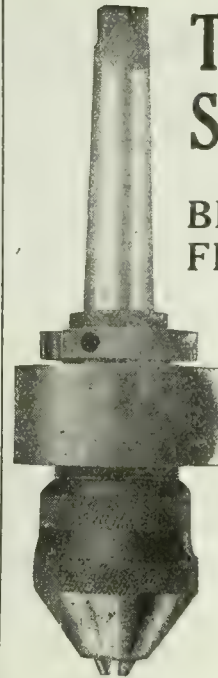
Fifty per cent. faster and more accurate than solid tools. No chance of work getting off centre.

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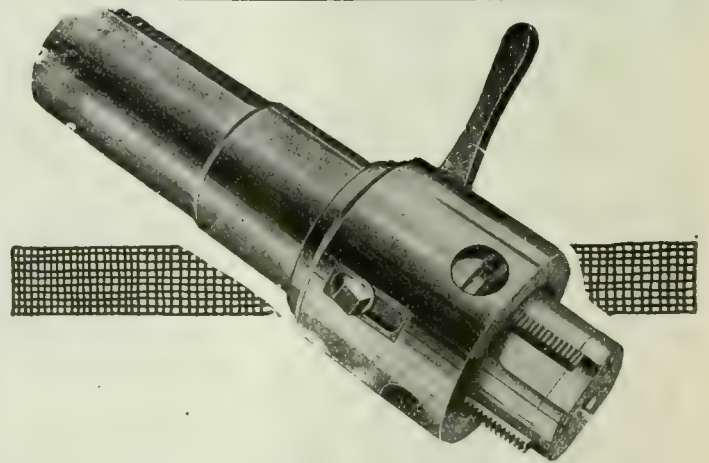
## Tap Chucks that Save Tap Costs

### BICKNELL-THOMAS FRICTION CHUCKS

reduce tap breakage to the vanishing point. These chucks will hold the tap to the limit of its endurance, but a sudden strain sufficient to break the tap will cause the grip to loosen instantly. They are particularly adapted for tapping to the bottom of blind holes, for special work and—owing to their compact design—for use on multiple spindle machines.

*Made in four sizes—one-eighth to one inch. Straight or Morse taper shanks.*

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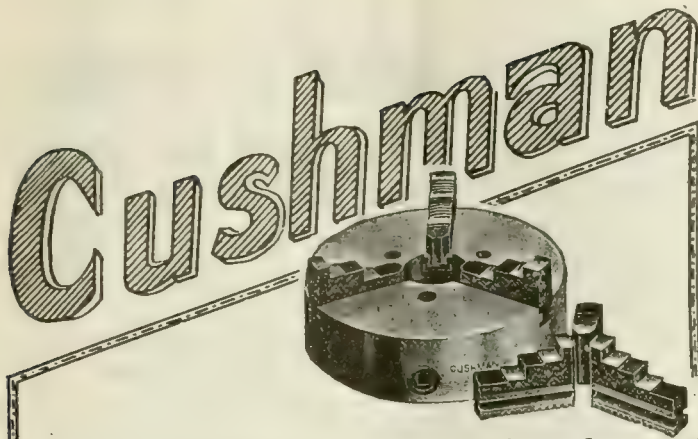


You have seen threads torn and roughed—the result of a tap clogging with chips when backing off. You have seen threads that no mechanic would call smooth and clean. But never have you seen anything but perfect threads in shops using Victor Collapsible Taps. Sizes 1¼" to 12". Moreover, Victor Collapsible Taps save fully half the time on threading operations.

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## The "Cushman" Chuck of to-day is the fruit of nearly sixty years of Chuck building

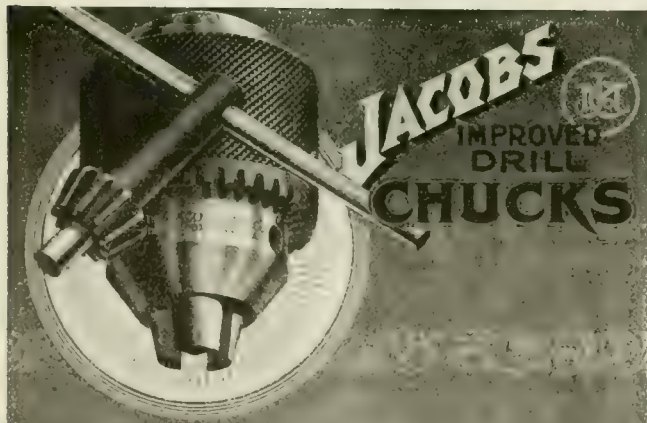
And right from the start in 1862, they have been known throughout the industry for their high quality Material and Workmanship.

The CUSHMAN Chuck of to-day embodies every up-to-date improvement of a long line of FAMOUS CHUCKS.

Send for our Catalogue showing complete line of Lathe Chucks, Drill Chucks and Portable Face Plate Jaws.

Cushman Chuck Co., Hartford, Conn.

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Made to work quickly, conveniently, safely and easily—closed and opened by a slight twist of the key—

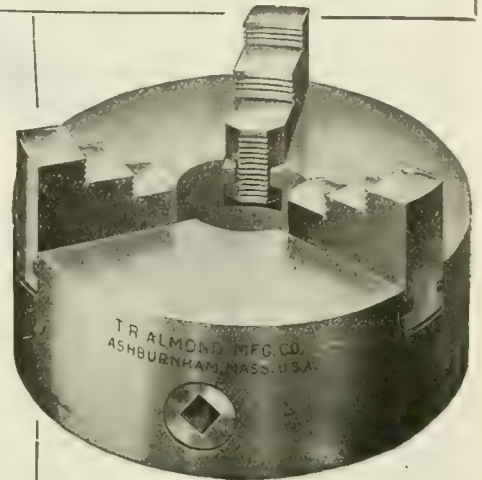
## Jacobs Chucks

hold tools firmly and precisely and save time and labor. Wherever durable, reliable chucks are demanded there Jacobs Chucks are found.

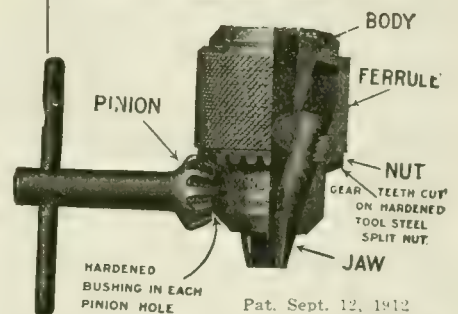
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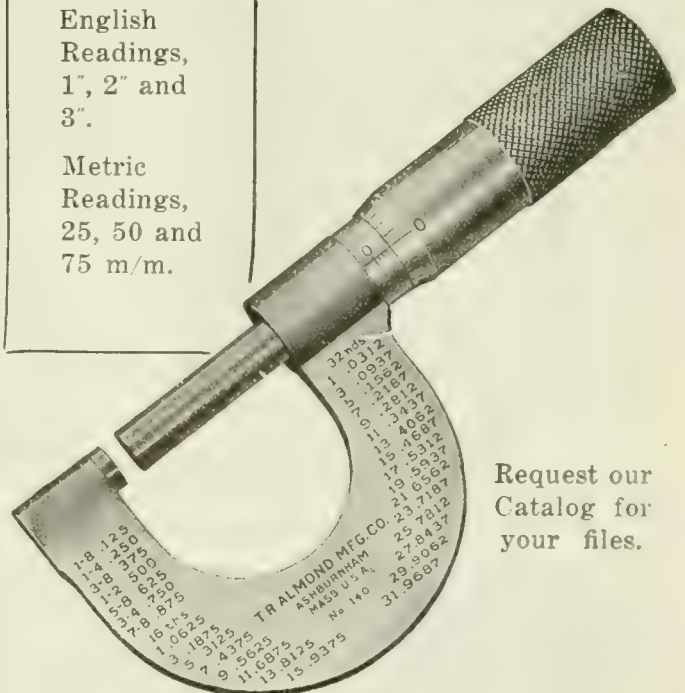
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English Readings, 1", 2" and 3".

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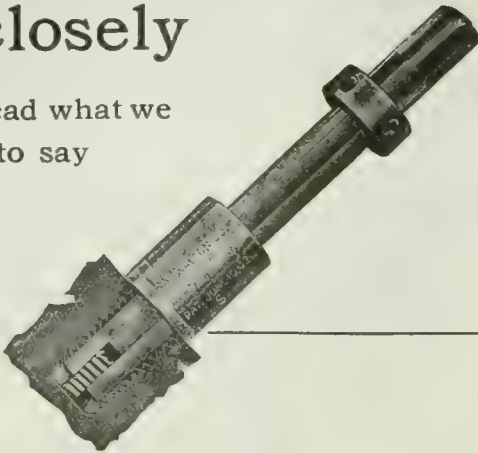
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**W**HEN a tap breaks off close or below the surface, you'll find this Walton Tap Extractor will save a great deal of time and trouble. The crucible fingers grasp the flutes of the tap, a twist of the wrench and the piece is out. Don't you think it would pay to have a few lying around on your benches?

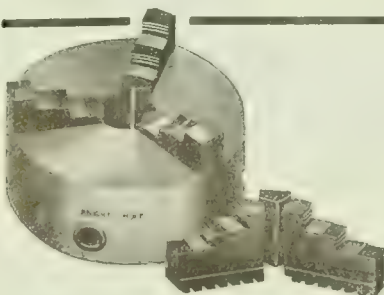
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## Any Cut a Machine Can Pull or a Tool Stand, the "Knight" Chuck Can Hold

The "Knight" Three-Jaw, Universal Geared Chuck is solidly constructed, its properly proportioned jaws are exceedingly powerful, and the scrolls are very strong.

Characteristics, ease of control, prompt adjustment, adaptability and great gripping power.

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## Die Head Cuts Perfect Threads

The H. & G. Die Head illustrated is only  $3\frac{3}{8}$ " outside diameter, yet it will cut from the smallest up to 1" standard thread and up to  $1\frac{1}{8}$ " fine threads. For absolute proof of its ability to stand up and give good results, see the perfect threads it cuts on nickel steel. You can see these many places, but in

almost any automobile or aeroplane plant for certainty.

Made in  $9\frac{1}{16}$ ", 1",  $1\frac{1}{2}$ " and 2" sizes.

No stronger, more durable, more accurate Die Head was ever made.

on  
**Nickel  
Steel**



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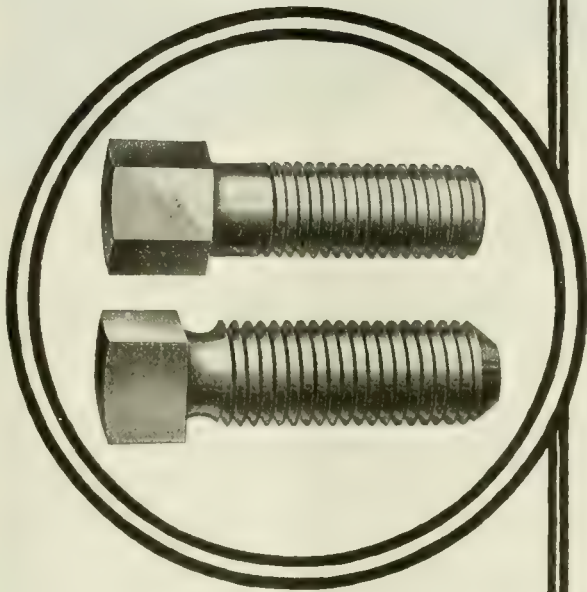
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New Haven - Conn.



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Special screw machine products  
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**DE COURCELLES & G.T.R. MONTREAL P.Q.**



# NORTON



## In these days of gigantic demand Nortons everywhere keep production up

Here's a grinding job up in Vermont at the Jones & Lamson plant. It's a Drum Drive Shaft for a J & L Turret Machine. The material is machine steel and its rough size is  $1 \frac{9}{32}$  in. x  $1 \frac{17}{32}$  in. x  $1 \frac{25}{32}$  in. x  $1 \frac{13}{32}$  in. The finished size is  $1 \frac{1}{4}$  in. x  $1 \frac{1}{2}$  in. x  $1 \frac{3}{4}$  in. x  $1 \frac{3}{8}$  in.

A limit is set of .0005 in.—and maintained at the rate of 28 complete shafts per day.

Isn't an installation—in a plant so thoroughly well known in the quality field as Jones & Lamson—an endorsement for Nortons that you can't afford to overlook when you are ready for grinding machines?

## Norton Grinding Company, Worcester, Mass.

Chicago Store: 11 North Jefferson Street

*Canadian Agents:*

**The Canadian Fairbanks-Morse Company, Limited**

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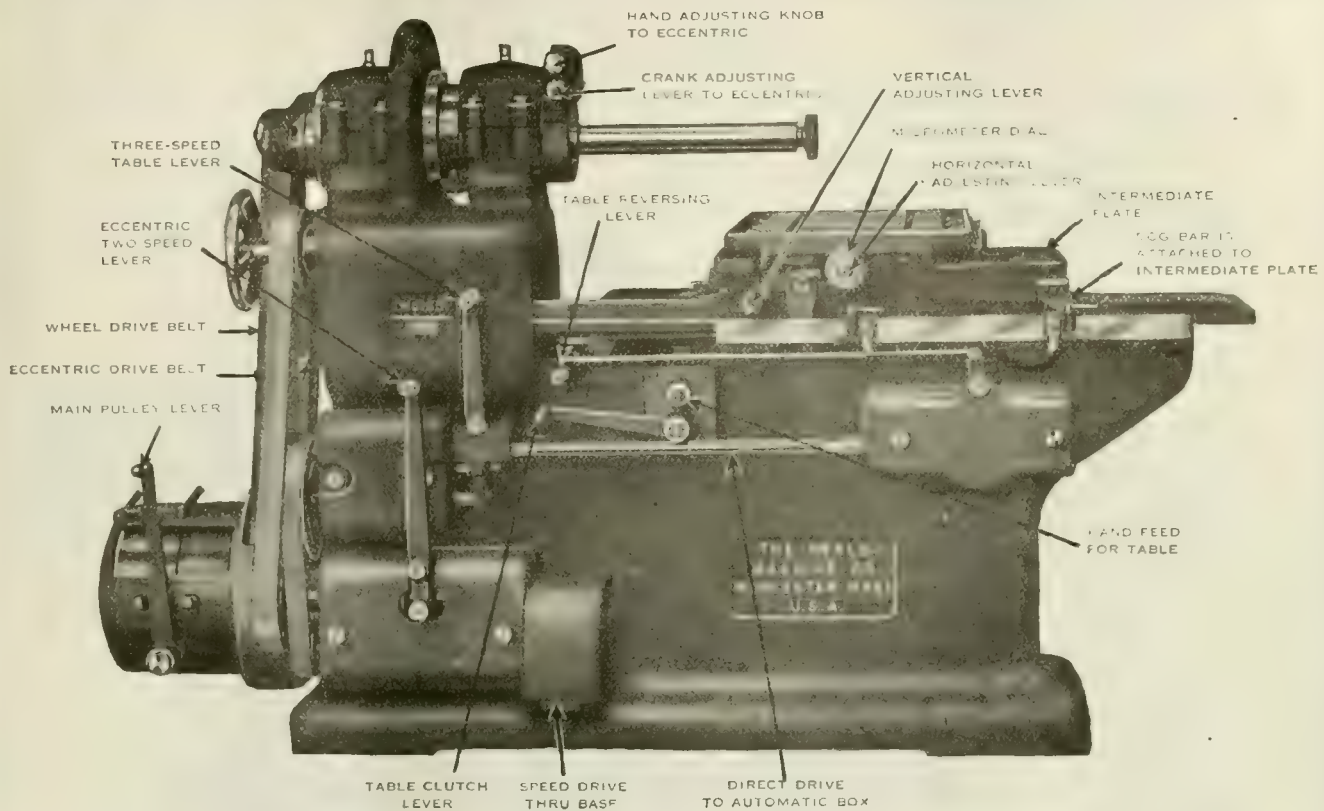
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Ottawa  
Calgary

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Vancouver

Hamilton  
Victoria





# A Production Proposition

## *The New Heald No. 65 Cylinder Grinding Machine*

It does not need an arrow to point out its massiveness and rigidity. A glance will show a production machine which is of vital interest to all manufacturers. The work table and grinding spindle are supported from the same solid base casting, which is wide enough so that when a large casting, such as a six-cylinder en bloc is being ground, it will not overhang to any great extent.

Notice that it is entirely self-contained, all drives being taken from a single unit on the rear.

Ample vertical adjustment is obtained for all manufacturing purposes by an inclined slide located between the main and cross slide table. Movement of this slide in either direction parallel to the main table raises or lowers the cross slide table and work.

By a very unique design the relation between the dogs, work and wheel always remains the same when a vertical adjustment is made. It is brought about by having the dog bar attached to the intermediate slide. This feature alone saves hours of the operator's time when grinding castings with more than one hole.

The drive of the wheel spindle pulley is through a flexible idler, one belt connecting with the idler and another belt transmitting motion to the grinding spindle. The tension of these belts is maintained automatically through a simple arrangement of levers and springs. Equal tension on the spindle pulley is particularly desirable, as it keeps the bushings from being pounded out of round.

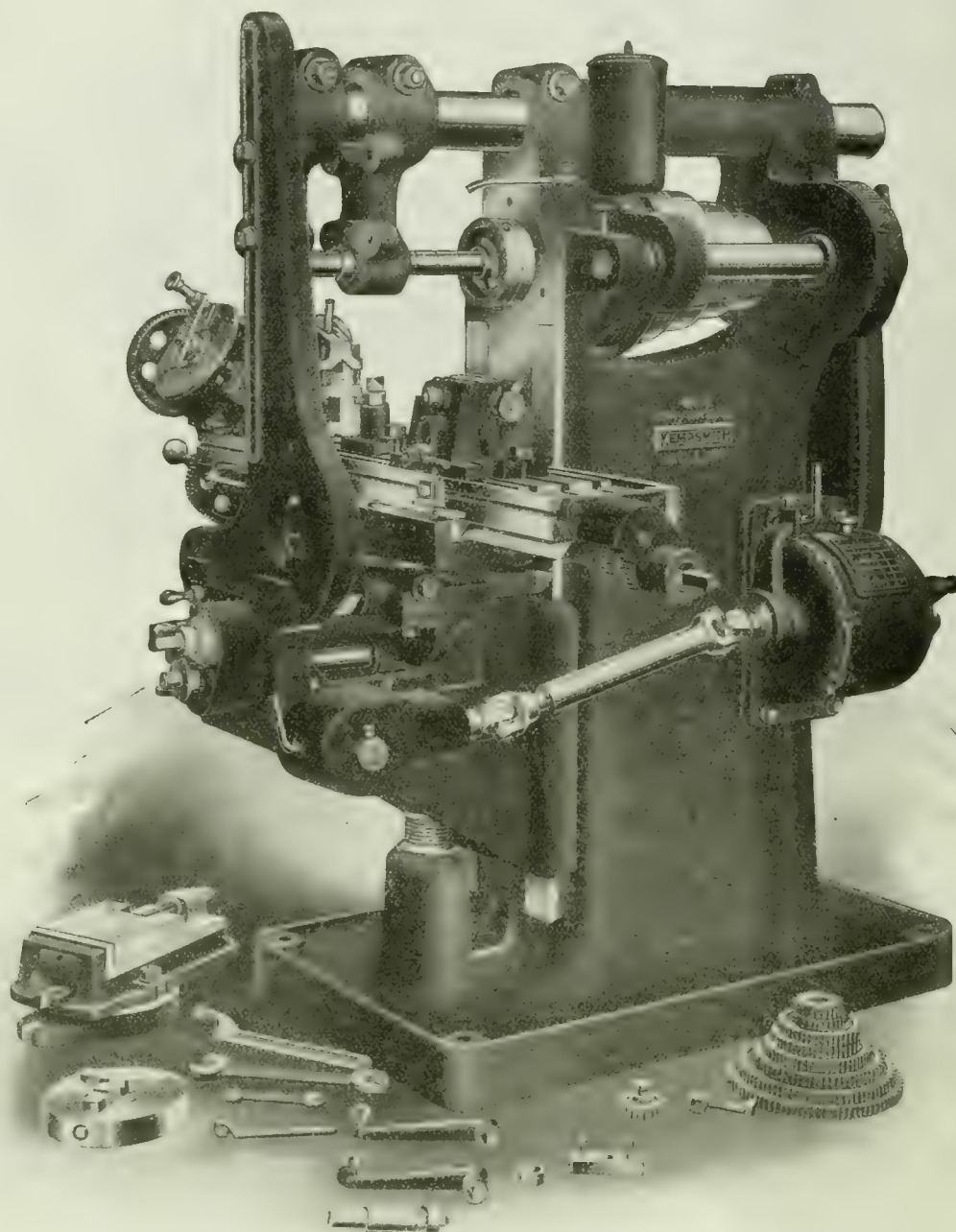
## **The Heald Machine Company** **Worcester, Mass.**

New York, 239 Singer Bldg. Philadelphia, 1199 Commonwealth Bldg. Chicago, 24 Jefferson St. Detroit, 911 Majestic Bldg. Cincinnati, 311 Provident Bank Bldg. Cleveland, 721 Engineers Bldg. Western Agents: Eccles & Smith Co., Los Angeles, San Francisco and Portland. Salt Lake Hardware Co., Utah and Idaho. Foreign Agents: Alfred Herbert, Ltd., England, Societe Anonyme, Alfred Herbert, France and Switzerland. Societa Anonima Italiana, Alfred Herbert, Italy. F. W. Horne Co., Japan. Wilh. Sonesson & Co., Sweden, Denmark and Norway. American Machinery Syndicate, Spain and Portugal.



## KEMPSMITH

### MILLING MACHINES



#### KEMPSMITH No. 2 Universal Milling Machine

**Equipment**—Double friction countershaft, 10½ inch Universal Dividing Head complete with tailstock, centering rest, Hill patent dog and driver, two index dials, set of change gears for spiral milling and index charts for operating; 6 inch Universal Chuck, 1 inch arbor, two arbor supports, brace, No. 3 Swivel Vise, outside tool shelf and all necessary crank handles, wrenches and accessories as shown.

**THE KEMPSMITH MANUFACTURING CO.**  
MILWAUKEE, WIS., U. S. A.

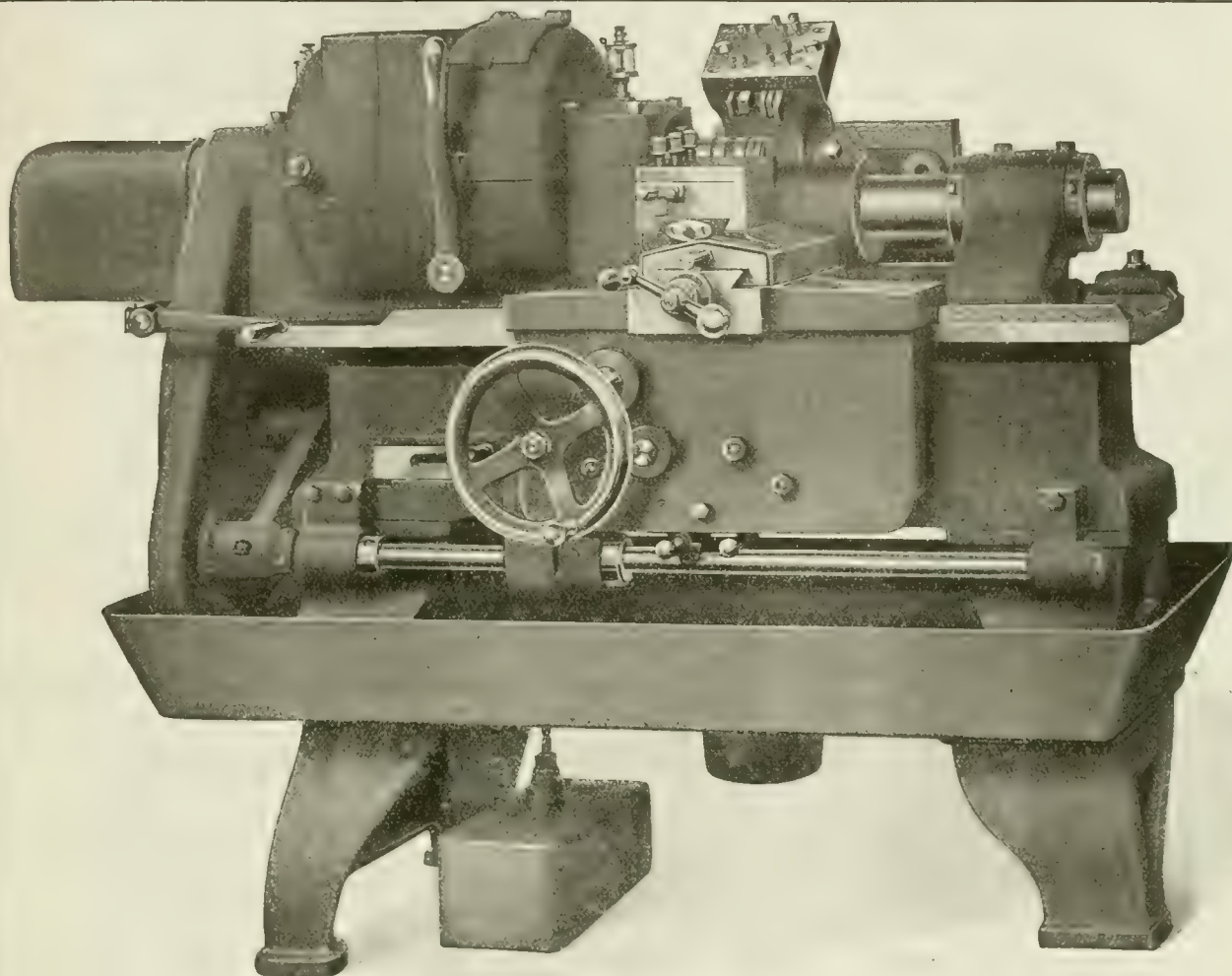


# REED-PRENTICE COMPANY

WORCESTER



MASS. U.S.A.



## PISTON PRODUCTION.

MACHINING PISTONS IS OFTEN A ROUGHING JOB ON A LATHE WITH THE FINISH COMPLETED BY GRINDING.

ON A LARGE SCALE, HOWEVER, THESE OPERATIONS ARE COMPLETED BY "REED-PRENTICE AUTOMATICS"—ONE BATTERY OF MACHINES ROUGHING, ANOTHER BATTERY FINISHING.

TWO MACHINES TURN OUT MORE THAN 200 PISTONS PER DAY.

"REED-PRENTICE AUTOMATICS" ARE DESIGNED TO SUIT ALMOST ALL TURNING, GROOVING AND FACING OPERATIONS THAT FALL WITHIN THEIR CAPACITY.

MAY WE TALK IT OVER WITH YOU?

YOU WILL NOTE THE PISTON PLACED IN THE MACHINE PICTURED ABOVE.

THIS MACHINE IS TOOLED FOR THE FINISHING OPERATION.

THE BACK ARM TOOL BLOCK CARRIES ALL THE GROOVING AND FACING TOOLS. THIS BLOCK "FEEDS IN" A CERTAIN PREDETERMINED DISTANCE.

THE FRONT TOOL BLOCK, MOUNTED ON THE CARRIAGE, HOLDS THE TURNING TOOLS, WHICH ARE SET TO GIVE THE CORRECT DIAMETERS OF THE PISTON.

BOTH TOOL BLOCKS OPERATE SIMULTANEOUSLY.

CANADIAN FAIRBANKS-MORSE CO., LTD.  
MANNING, MAXWELL & MOORE, INC.  
FENWICK FRERES



# Notes on Grinding

NORTON COMPANY,  
WORCESTER, MASS.

## More Don'ts for the Cylindrical Grinding Machine Operator

Don't attempt to take too deep cuts; lighter cuts and more of them will produce as much work and still keep the wheel true and in better shape for a greater length of time. Still you must use good judgment; **excessively light cuts** will permit the wheel to glaze over and not cut properly.

Don't forget that a generous use of the diamond yields large returns in dollars and cents.

Don't attempt to grind round work with a wheel that is out of balance. You should try the wheel for balance as it wears down. One balancing is not sufficient to insure a wheel remaining in balance throughout its entire life.

Don't try to grind without chatter marks when all the belts on the machine are uneven in thickness and bumping every time they pass over the pulley.

Don't try to grind work in your machine which is beyond the capacity of the machine both for length and swing.

Don't remove the wheel spindle of your grinding machine just for examination of the bearings.

Don't expect perfect bearings in the box of the wheel spindle, for such a thing is impossible and unnecessary.

Don't press the point about the bearing in the wheel spindle box, because if the spindle is round you will get perfectly smooth rotation in a box, even if it only bears at three points. Our machines are made to grind round and perfect work—not as exhibitions for scraping in the wheel spindle boxes.

Don't say that chatter marks are caused by imperfect scraping of wheel spindle box bearings. Scraping never was and never can be the cause for chatter marks.

Don't undertake to adjust the wheel spindle boxes unless you have had experience with such work. Better wait for our demonstrator's next call and let him help you adjust it.

## NORTON COMPANY

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal,  
Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon,  
Vancouver, Victoria. F. H. Andrews & Son, Quebec, Que.

Grinding Wheel Plants, Worcester, Mass.

ELECTRIC GRINDING PLANTS NEW YORK STORE CHICAGO STORE  
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Because they are processed entirely by the most expert workmen in this highly specialized trade.

Because they are made in Canada by Canadian Capital and Canadian Labor.

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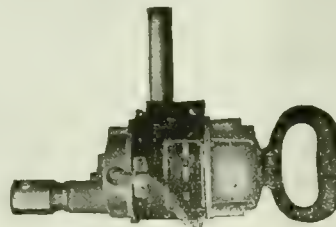
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Save Time Labor and Money



They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

### 3 SIZES

3-16 in., W.G.T., 6 lbs

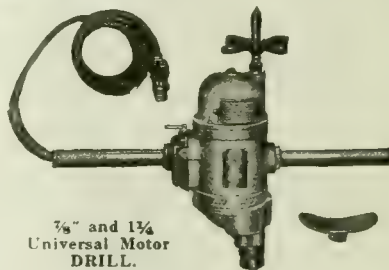
1/4 in., W.G.T., 9 lbs

3/8 in., W.G.T., 12 lbs.

All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



3/8" and 1 1/4" Universal Motor DRILL.

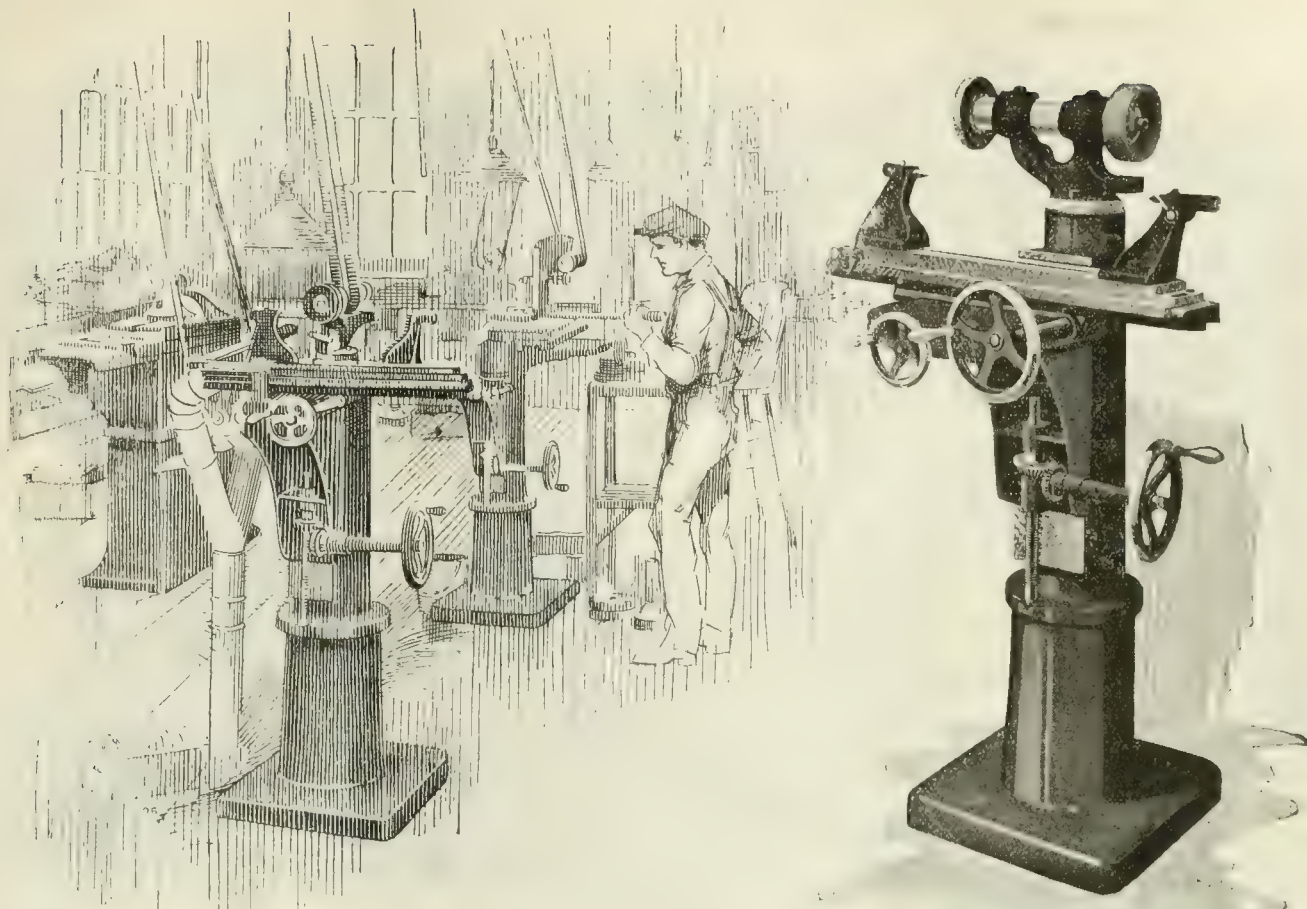
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THE UNITED STATES ELECTRICAL TOOL CO.  
CINCINNATI, OHIO





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They will assist your toolmakers quickly to accomplish the work, and will thereafter keep your tools in the pink of condition.

### *A Trial Convinces*

Number 39 Machine Tool Catalog describes them in detail



[ MACHINE TOOL DIVISION ]

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 A study of the construction of  
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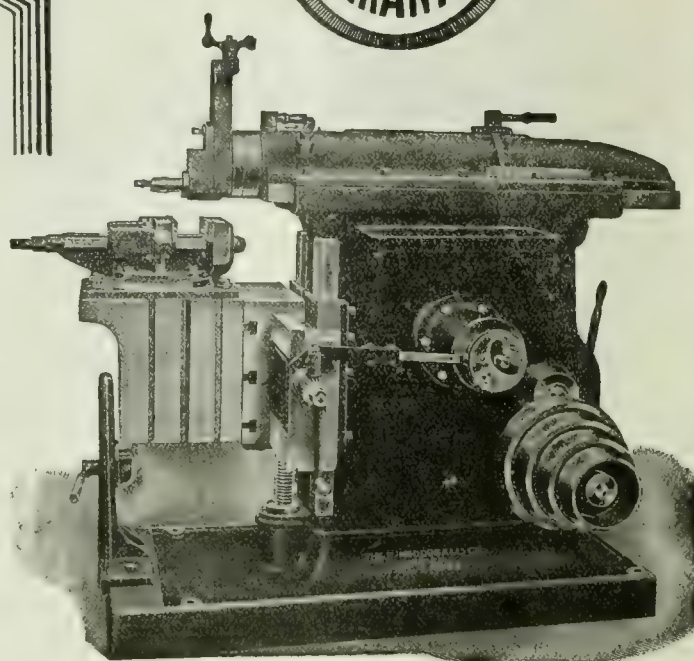
ALL FEATURES AIM TO HIGHEST EFFICIENCY PLUS BIG PRODUCTION.

May we send you full details?

**The R. McDougall Co., Ltd.**

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"Matthews-made" steel stamps and lettering dies make easily read and durable marks on all classes of products. Matthews Champion Type Holders—for flat and convex surfaces—with interchangeable Steel Type, save time and lower marking costs. Matthews Inspection Hammers of best Pittsburgh Steel, are fashioned with the "know how" of over 50 years' experience.

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The Periodograph, for time recording in factories, places in your hands the reins of accurate control. Operator's attendance kept. Operator's time reported quickly and accurately. Work definitely scheduled. Cost records simplified.

The Periodograph is made by the makers of the Gisholt Turret Lathe. It has all the Gisholt characteristics of unity of purpose and plan.



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Operation <i>Turret</i>	
2.60	
20	
Finished	
Started	50
Finished	
2 MAY 113	
1 MAY 000	
Total Periods	
Hours	
Labor Cost	
Stopped	Completed
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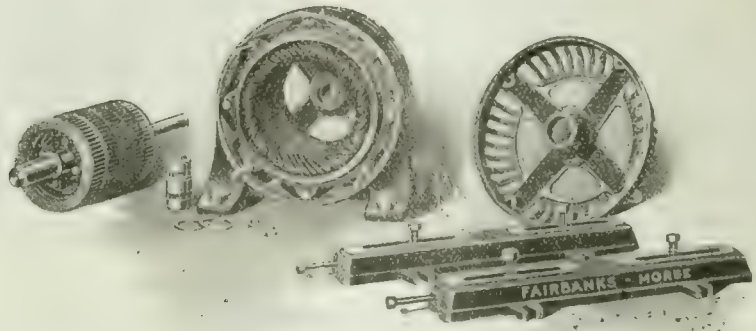
Write  
for the  
Book—  
"Better Factory  
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Builders of Standard and Automatic Turret Lathes; Vertical and Horizontal Boring Mills, Tool Grinders, Small Tools, Special Machinery, etc.  
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No joints in the rotor—the end rings are cast in place. Ball Bearings save money. They are efficient and clean. They require only occasional lubricating with grease. The motor may be mounted on wall or ceiling without changing the motor frame. The ball bearings have no distinct top and bottom.

**Tens of Thousands of Dollars' Worth of Machinery is for Immediate Shipment**

We have in stock at Toronto and Montreal, tens of thousands of dollars' worth of machinery, machine tools and supplies ready for immediate shipment. Let us quote you on that basis.

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St. John	Quebec	Montreal	Ottawa	Toronto	Hamilton
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# CANADIAN MACHINERY

## MANUFACTURING NEWS

Vol. XXI. No. 12

March 20, 1919

## Manufacturing the Ford-Smith Miller

An Article Regarding the Manufacture of Millers and the Inspection Methods Involved—These Are the Only Millers Built in Canada, and For This Reason the Article Should Prove of Special Interest

By J. H. MOORE, Associate Editor Canadian Machinery

THE plant of the Ford Smith Co. was described in CANADIAN MACHINERY last week and in this article additional material is presented dealing more particularly with the building of the Ford-Smith Miller. Its manufacture from the rough casting right up to the finished product will be described, and since the casting is per-

haps the first item with which we are concerned, the method this firm uses to take care of its casting problems will first be described.

All castings from the largest to the smallest are carefully cleaned, the larger ones, with brush and portable grinder, the smaller usually by the tumbler barrel route. Fig. 4 illustrates one of the

workmen at work on a base casting, using the portable grinder. He is removing a fin which sometimes gathers at the flange shown on photograph. All due care is taken to see that these castings are in proper condition before becoming a part of the finished product.

Fig. 3 represents the method of storing and keeping tab on small castings.

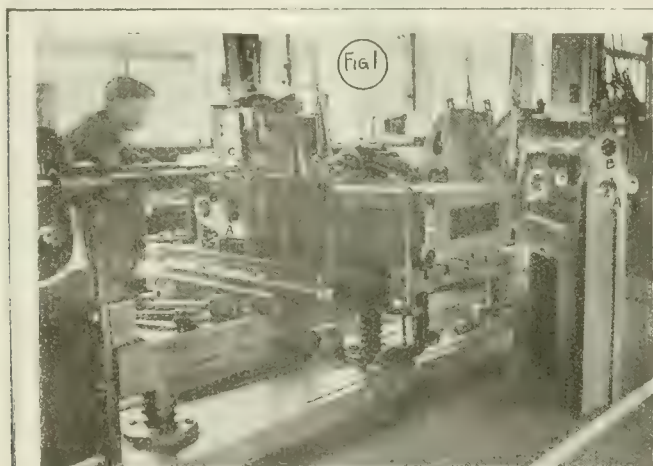


FIG. 1—BORING THE COLUMN. FIG. 2 PLANING THE KNEE. FIG. 3—METHOD OF STORING SMALL CASTINGS. FIG. 4—CLEANING CASTINGS WITH PORTABLE GRINDER



These castings are stored in a shed, either in racks, shelves, or bars, but for convenience in photography, the ones shown were moved near the doorway. All castings are tagged and plainly marked as to their proper symbol number, for it is a rule throughout this plant, that all pieces even to the smallest steel piece must have a symbol number. By such a method these castings can at any time be sent out to the shop without confusion or overlapping of operation.

#### The Base

Starting from the floor the first portion dealt with would be the base of the machine, but as this piece is strictly planer work, with a few holes to be drilled later on, no special mention of the operations on this part are necessary.

Next in order is the column. The various operations connected with it will be gone through in sequence.

First the column is placed on the planer, where the bearing surface for the knee is machined. The work is then turned completely over 180 degrees, and the back portion, that is, where the gear guard fits on, is planed to size.

The column is now swung crosswise on the planer bed, and the gear box pad is machined, while the bottom of the column is also finished at the same set up, by means of a special extension tool holder.

The column is then taken to the boring mill as shown at Fig. 1, and goes through the next operations. First, the main spindle hole A is bored and reamed, after which the table of machine is moved, until the overarm hole B comes into boring position. This hole is

then bored and reamed. Lastly on the same set up, the back gear spindle bosses C are brought into position when they are drilled and reamed. Some of the various tools used in these operations are shown in the photograph.

The column is now moved to the drill press, and the various holes down the back of the column are drilled. As these holes accommodate studs on which run the gears of the feed gear train, it is important that they be absolutely correct. Fig. 5 illustrates this operation, the jig used, and its construction.

First, and most important of all, the jig is located from the main spindle hole, and also butts up against the gear box pad. In this way the holes are always sure to be in the same relative position to the spindle and gear box. The other general drilling operations on the column, are hardly of such importance, so no special mention is made of these minor operations.

#### The Knee

Next in importance comes the knee. This casting is first planed for the slide on column, as shown in Fig. 2. The work is then turned over 180 degrees and the portion where cross feed handle thimble goes, is machined for size.

The cross feed slide is next machined, after which all portions are tested for alignment and accuracy.

Next the knee goes to the drill press, where various operations are performed, one of which is shown on Fig. 6. In this operation, the two holes for feed shafts are being drilled, and it will be noted that these are located from the cross slide, making sure not only of alignment, but at the same time accuracy of centres, and correct height from slide.

Numerous tools as used are shown in the photograph.

All other drilling operations on the knee are jigged carefully, with the exception of the knee elevating shaft hole. This portion is laid out by hand directly from the centre location of the elevating screw hole, and same is carefully marked and drilled to secure absolute accuracy. While being drilled the knee rests on a special jig plate which holds it at the proper angle.

#### The Saddle

Next in sequence comes the saddle, and this piece combines both planer and lathe work. First the slide for knee is planed, after which the piece is placed in a special fixture suitable for such class of work. The face of saddle is now turned, at the same time boring the centre hole.

#### Saddle Swivel

This casting is also a combination of planer and lathe work. The slide for the table is first planed, after which a lathe fixture on the same principle as used for the saddle is adopted. The bottom of the swivel is now machined and bored, after which the rim of swivel is graduated on a special graduating attachment for the purpose. This operation is completed on the milling machine.

#### The Table

The slide of table is first rough finished as shown at Fig. 7. This is strictly a straight clamping proposition, so no further comment is necessary. The table is then turned completely over, and placed on two cradles, similar to the one shown at A (see the photograph Fig. 7). The slide rests on these cradles, and is held in position simply by means of two set screws, with a stop clamp in front to take up the thrust of tool on the work. The top of table is now machined, including the tee slots, at this same set up.

The idea of holding the table in such a loose manner, is in order to ensure that all spring is taken out of the castings. After the top has been completed, table is once more turned over, and the slide is now finished up complete, this concluding the planer operations. Photo, Fig. 7, illustrates one table only in place, but usually these are planed in lots of six. One was set up especially for the photographer, in order to show the operation.

#### The Spindle

The operations on this important position of the miller are carried out with great care. First the front end of spindle is bored and reamed, but only drilled about half way through the spindle. This operation is carried out with the aid of the steady rest, the carriage of lathe being between the rest, and the headstock.

A test bar is now placed in the taper hole in the front of spindle. This bar is about 20 inches long. The work is now tested for concentricity, and after assured on this point, a short portion about two inches long, close to the chuck, is turned on the spindle.



FIG. 14—MR. WITHERSPOON, GENERAL SUPERINTENDENT OF PLANT.



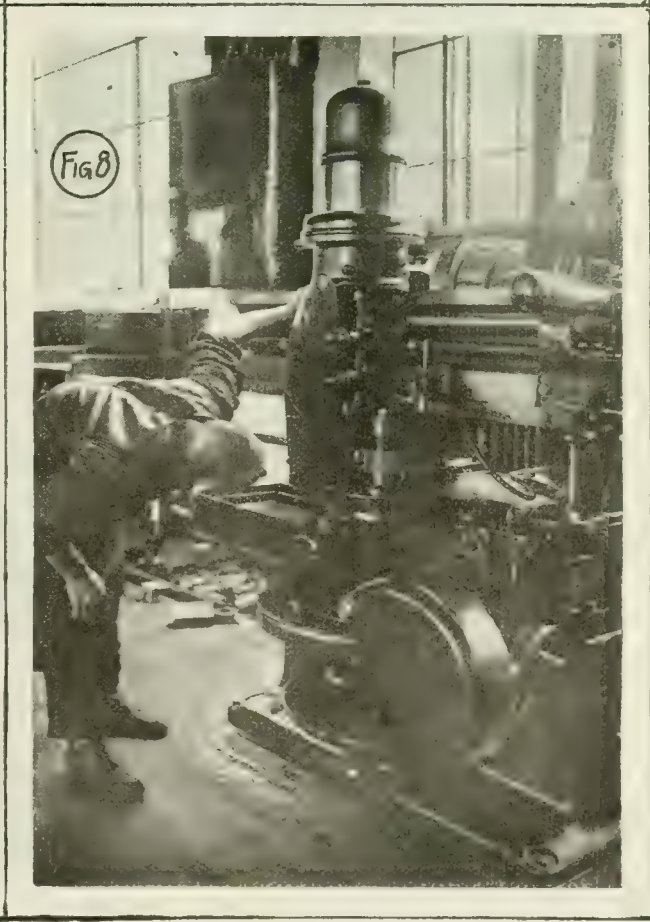
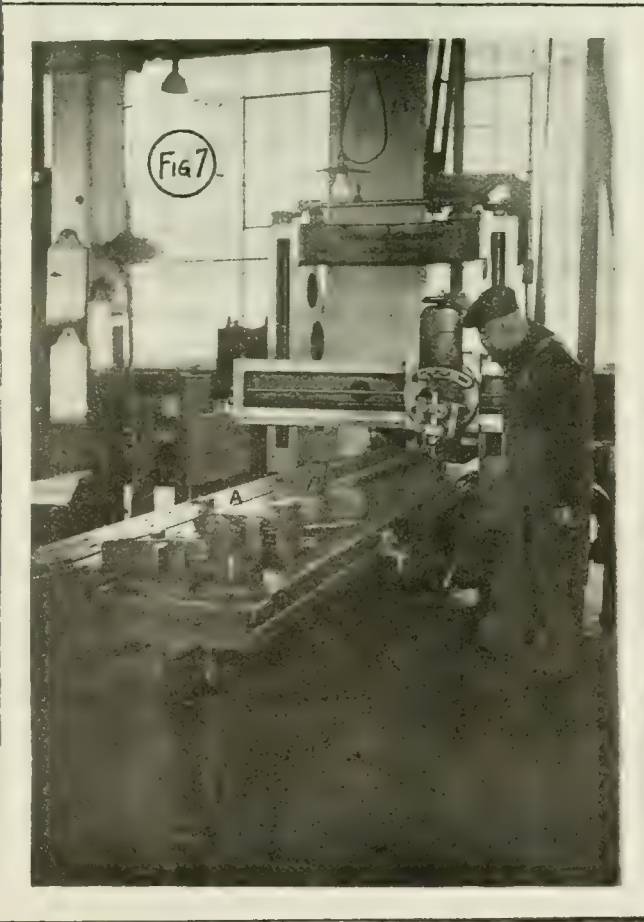
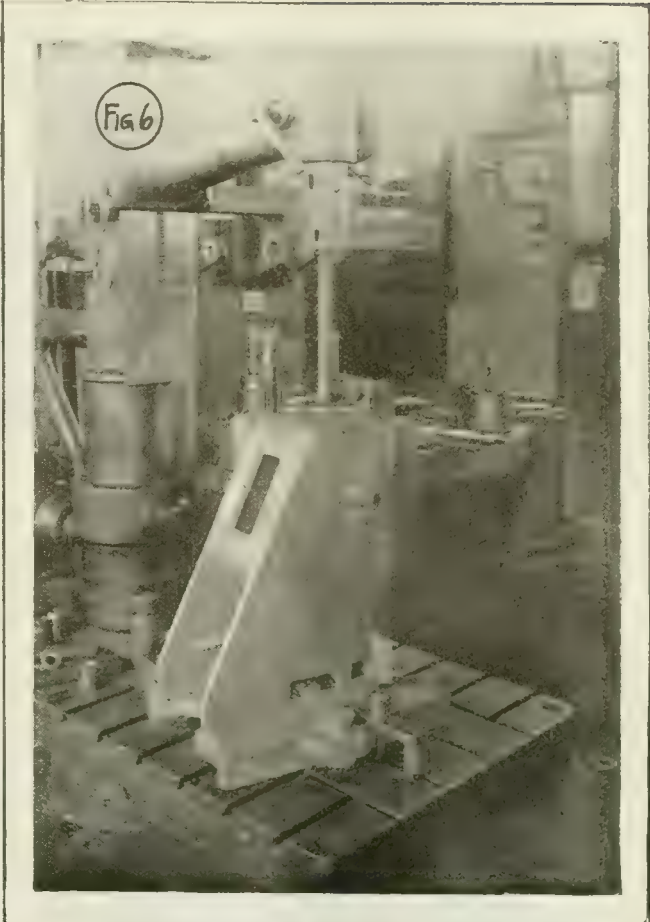
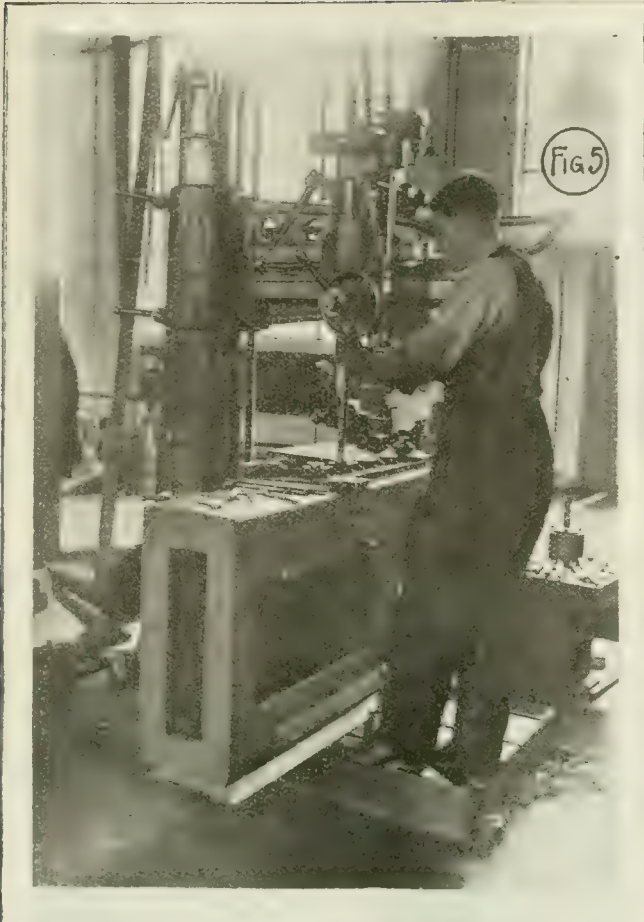


FIG. 5 SHOWING THE HOLES IN BACK OF COLUMN BEING DRILLED. FIG. 6 OPERATION OF DRILLING CROSS FEED HOLE IN KNEE. FIG. 7 FIRST ROUGH PLANING OPERATION ON THE TABLE. FIG. 8 GEAR CUTTING OPERATION.



The work is now switched around end for end, the two inch finished portion being placed in the steady rest. After chucking correctly, the balance of the hole through the centre of spindle is completed.

The work is now finish turned on centres, and the taper portion is machined by a special fixture attached to lathe. This fixture was designed by W. Witherspoon, the superintendent of the plant.

#### Other General Details

As regard the other numerous details, it is noticeable to a marked degree that, wherever necessary, all portions are

carefully jigged, but as the general operations are of the usual nature found in the average machine tool plant, no special description is given.

Fig. 9 as illustrated is merely a view given in order to show readers the various parts used in the making up of the feed gear box. The casting of gear box, toward the back of photograph, is carefully jigged, drilled, reamed, then bushed, with high grade bronze. The gears are all constructed of material suitable for the particular use for which they are intended, and of sufficient size and pitch for strength.

Wherever necessary, these gears are cut on a No. 6 fellows gear shaper, en-

suring perfect teeth, and ease of mesh. This is particularly true of the gears which slide into mesh, and to further facilitate this shifting problem, the gear teeth are all carefully rounded at the edges. Gears also go through a form of inspection, and, since coming to and mentioning inspection, we will follow up the rigid system as practised throughout the manufacture of these machines.

#### Inspection Methods

The system of rigid inspection as adopted by this firm is a study in itself. From the very drop of the hat as it were, the various foremen throughout the shop are responsible for the

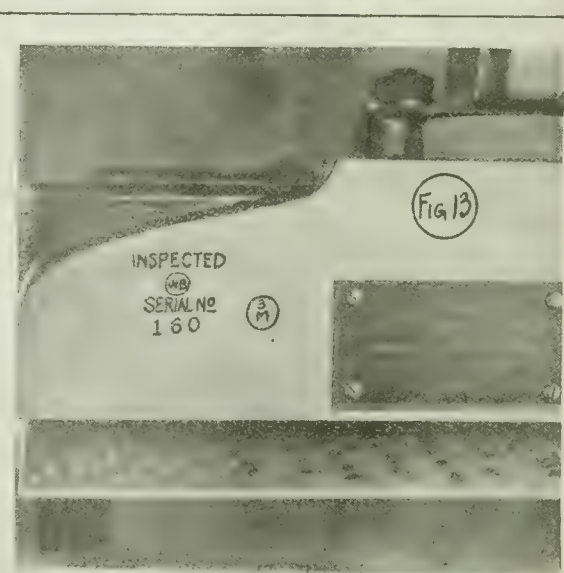
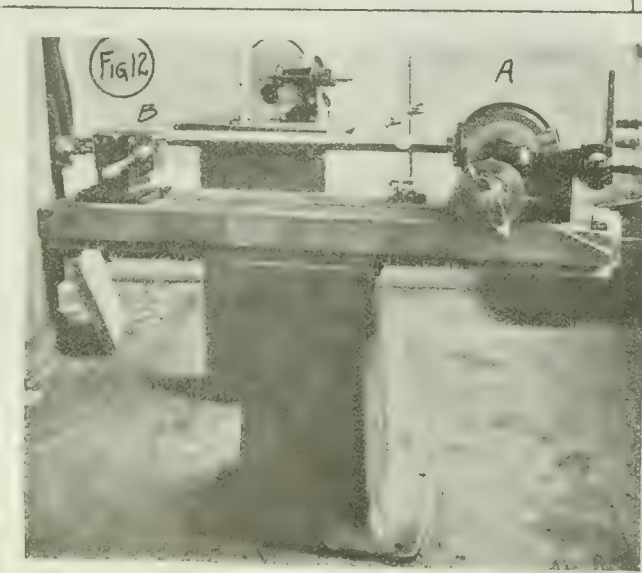


FIG. 10 TESTING THE KNEE FOR ALIGNMENT, IN RELATION TO COLUMN. FIG. 11 TESTING THE SPINDLE FOR CONCENTRICITY. FIG. 12 TWO TESTS ON DIVIDING HEADS. FIG. 13 INSPECTION SYSTEM OF STAMPING AS APPLIED TO TABLE.



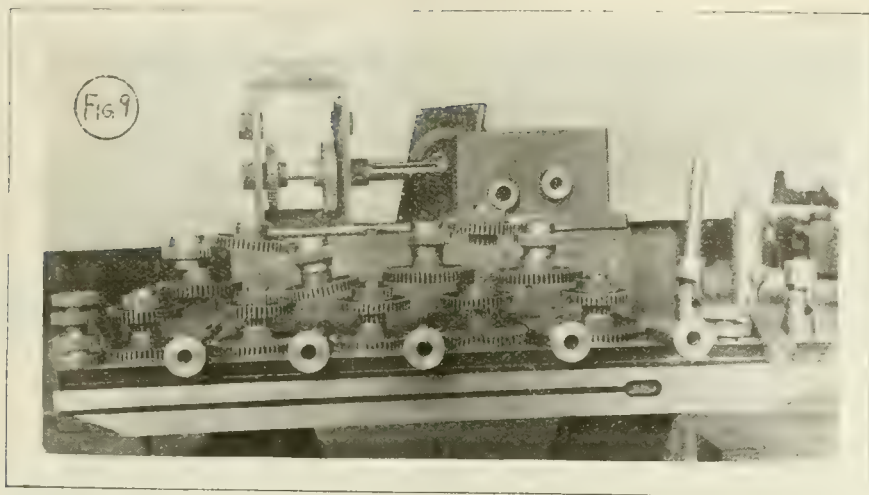


FIG. 9 A GROUP OF GEARS

operations being carried on, and after each sequence of operations they must carefully inspect the work, and place their stamp of approval on same. Should at a later operation some error be found in this piece, it becomes a simple matter to trace its source, for the stamp placed by the foreman places the blame where it belongs. To show all the stamps that are used is not possible in an article of this length, but a very good example of such a stamp is shown at Fig. 13.

It will be noticed that this is the table which has been stamped, and that the reading of same is as follows: "Inspected W. B. serial No. 160." To the right of this mark readers will notice a smaller stamp marked 3M. The latter stamp denotes the size of miller that table is used for, namely No. 3 size, the M designating the foreman's initial.

The same system applies to all parts of this miller, from the smallest pieces up to the largest. No work is allowed to pass except in first-class shape, for naturally the foreman has no desire to receive a call down for poor work passing through his hands. The final stamp of approval on the miller after completion and test run, is given by the assistant superintendent personally, so as readers can readily see strict inspection, in the truest sense of the word, is this firm's motto, which by the way would be a fine thing for Canadian tool builders to adopt in general.

Regarding other tests relative to the actual assembling of the machine, it is impossible to illustrate all these schemes but two are shown at Figs. 10 and 11. At Fig. 10 we have the test of alignment of knee in relation to the column. To obtain this test the operator proceeds as follows. He first places a special test bar in the spindle hole, then places the knee, with its bevel gib side up against the column way of similar shape. He now takes the test instrument, which is of similar construction to a surface gauge and tries at various portions of the bar to ascertain how much, if any, the alignment is out. A small dial at front of instrument shows clearly in thousandths of an inch the error, and of course, should there be an error in this regard it is quickly rectified.

Fig. 11 represents the test to main spindle after completion. A parallel bar is placed across the ways of lathe, and the same instrument as before is used. A special test bar about 20 inches long is placed in the front hole of spindle. Lathe is then started, and instrument is moved along the shaft to test concentricity.

#### Dividing Heads, Etc.

In addition to their millers, this concern manufacture all necessary attachments, usually found on such machines. Vertical attachments, universal milling attachments, etc., etc., are all built with the same painstaking care, but perhaps the most important of all is that of the dividing head. Two of the tests on this head are shown in Fig. 12 for illustrative purposes.

In the foreground of the photograph a pedestal is seen, on which is permanently mounted a miller table complete in all details. All tests are made on this table, the particular one as illustrated being to determine if the head A and the centre block B are in correct alignment as to height.

A test bar is placed between the head centre, and centre block, when the instrument already spoken of is placed on the table, and trials made at various points along the bar. Should any error be shown on the test dial, it is at once corrected.

#### ELECTRICALLY HEATED CLOTHES

The British aeroplanes-de-luxe which were used for carrying officials connected with the Peace Conference between London and Paris were equipped not only with electric light in the cabin but also with electric circuits for heating the clothing of the pilots and passengers. The clothing contains a network of electric resistance wires in the arms and legs, and when these wires are connected to the electric circuits they become warm. It was a British engineer who first worked out the quantities of electricity needed to keep the human body comfortably warm when applied in this way to the extremities. The amount is surprisingly small, being only about as much as is taken by an electric lamp of one hundred candle power. In a little while we may find the same system used

by Arctic explorers for their sleeping bags, by look-out men, and steersmen on board ships in cold latitudes, and also by motorists and others exposed to strong winds and low temperatures. Medical applications also readily suggest themselves. It was on a British ambulance, by the way, that electric radiators were first fitted to the stretchers to keep the wounded warm and prevent collapse on the way to the hospital.

#### COL. CARNEGIE

On Monday evening, March 3rd, Colonel Eben. Carnegie, president of the Electric Steel & Metals Co., Ltd., and managing director of Electric Steel and Engineering, Ltd., invited the staff to dinner at the New Dexter Hotel to meet Geo. C. MacKenzie, B.Sc., of the Mines Department, Ottawa, who has been appointed general manager of the company.

After dinner, Col. Carnegie, in introducing Mr. Mackenzie, reviewed the operations of the company, pointing out that it was one of the first in Canada to manufacture munitions, and right up to the signing of the armistice was actively engaged on this work. The speaker spoke of the loyalty, co-operation and support he had always received from the staff, and stated that although he was resigning from the active management of the company, to return to England, he was still to remain a director of both companies, and hoped to visit Canada from time to time.

Mr. MacKenzie, in replying, expressed his pleasure at having the opportunity of meeting the staff under such favorable conditions, and assured them that he was determined to do his part to make the company a success, but that could only be accomplished by the co-operation of everyone.

Mr. F. Birley, secretary of Electric Steel & Metals Company, expressed the regret of the staff at Col. Carnegie's retirement from the management, and on behalf of the staff assured Mr. MacKenzie of the same loyal support which had been given to Col. Carnegie.

The Welland orchestra was in attendance, and everyone spent an enjoyable evening in dancing and the selection of songs rendered by Mrs. Buckley and W. Burkinshaw.

#### CHANGES ANNOUNCED

The Canadian Ingersoll-Rand Company, Limited, has recently absorbed the Jenckes Machine Company, Limited of Sherbrooke, Que., thus putting them in possession of two plants, the "Jenckes plant," and the "Rand plant." The products of the "Jenckes plant" will continue to be those familiar to customers of the Jenckes Machine Company, manufactured to the latest designs. Briefly, these are: structural and plate work; tanks, penstocks, etc., mining machinery and equipment, ore crushers, cars, cages, etc., and pulp and paper equipment such as hoppers, grinders, water wheels, etc. The headquarters of the Canadian Ingersoll-Rand Company are at 260 St. James St., Montreal.



## The Adaptability of Oil Fuel to Industrial Purposes

In 1917 the largest quantity of oil fuel used for furnace purposes was for heating billets in connection with the manufacture of shells, while in pre-war times the principal consumers were glass bottle manufacturers and makers of rivets, bolts and nuts. For forging or drop stamping wrought-iron materials the metal must be heated up to about 2,500 deg. F. This temperature was formerly obtained by placing iron bars in a coke furnace of the type used by the wayside smith, though of improved construction and larger dimensions. Till gas and oil fuel were introduced the process was rather a slow one, but since oil has been used in an intelligent manner the output of each new or converted furnace has been trebled. Further the size of the furnace is reduced by 30 per cent. The working area occupied by a furnace and its adjacent machines is only about 50 per cent., more area has to be occupied by a stack of coal and behind it by the resultant ashes. With oil fuel these spaces can be used as furnace pitches.

In recent years many metal-melting manufacturers have either scrapped their coke-fired furnaces or converted them to gas or oil. Of these two gas is probably to be preferred, except that its calorific value in any town may vary hourly while that of oil is constant. The principal metals melted at present are aluminium and 70/30 brass. The former is usually melted in "lift out" crucibles, the melted metal being carried to the moulds, whereas brass is melted in tilting furnaces, to which the moulds are brought. For liftout furnaces melting low fusion metals the average oil-fuel consumption is about 15 per cent., and for tilting furnaces about 10 per cent. of the metal melted; that is, for every 100 pounds of metal melted the former would consume about 1½ gallons and the latter 1 gallon.

In the early years of this century a French engineer took up the case of oil as an auxiliary to coal. Several evaporative trials were made with the boiler of a French Navy ship burning coal alone at the rate of 188 lb. per sq. ft. of grate per hour and burning coal and oil in different proportions at the rate of 21.3 and 21.7 lb. of mixed fuel per sq. ft. When a mixture containing 45 per cent. of petroleum was burned the evaporation showed an increase of 25 per cent. over that with coal only, and when the proportion of petroleum was 64 per cent. there was an evaporative increase of 56 per cent.

About four years ago power-station engineers began to take an interest in the subject, on the theory that in conjunction with oil fuel a poorer class of coal could be used than could be burnt satisfactorily under the boilers. Poor coals tend to cake on the links of the chain grate stokers, preventing the quantity of the air necessary for complete combustion from being drawn in;

hence a smouldering mass travels along the bars and is dumped into the ashpit only partly consumed. But with oil fuel the argument was that, owing to the almost perfect combustion obtained, the combustible gases rising from the coal fuel bed would be quickly ignited and would cause the mass to become much more incandescent, thereby tending to aerate the bottom mass, which would then allow sufficient air to be drawn through to complete the combustion of the rest of the poor coal. Tests were carried out under a coal-fired Stirling water-tube boiler. One burner was placed on each side, about 25 per cent. from the back of the grate, and oil gravitated from an overhead tank to the burners, which were of the Kermode steam-jet type, working with steam at 25 lb. pressure. In the first test a nutty slack having a calorific value of 10,400 B.T.U. was employed, and a boiler efficiency of 69.25 per cent. was obtained; the temperature of the combustion chamber was 2,648 deg. F., and of the uptake 660 deg. The last of the tests was carried out with a nutty slack of 10,300 B.T.U., and Mexican fuel oil of 18,750 B.T.U., the proportion of oil to coal being 8 per cent. on a B.T.U. basis and 4.96 per cent. on a weight basis. A boiler efficiency of 74 per cent. was obtained, and the temperature of the combustion chamber was 2,850 deg., and of the uptake 628. With coal at 20s. 10d. a ton and oil at 50s. a ton, the cost of a ton of water evaporated with coal only was 2.8s. as against 2.62s. with coal and oil, the money saving with the latter thus being 6 per cent.

## CAN NOW SHIP TO OLD COUNTRY MARKET

**Announcement Made That All the Restrictions Have Been Removed**

Ottawa.—All restrictions on imports from all parts of the British Empire to Great Britain have been removed. This announcement was made to the House of Commons by Sir Thos. White in reply to a question by Hon. Charles Murphy. Mr. Murphy quoted a statement in a newspaper by Mr. F. H. Jones of Montreal, just returned from Great Britain, where he had been acting in an advisory capacity to Sir Robert Borden, to the effect that import licenses discriminated against Canada. Mr. Murphy also quoted from a cable despatch showing that the matter had been discussed in the British Parliament.

Sir Thomas White said he was glad to say that he was in a position to satisfy the House that there had been no intention to discriminate against Canada. He read two cables as follows:

From Lloyd Harris of the Canadian Trade Commission in London: "In reply to question in House this afternoon's Parliament, Secretary Board of Trade

says: 'The Government had decided no import restrictions shall be or continue to be imposed on goods coming from any part of the Empire, without the assent of the Cabinet, which shall not be given unless some unforeseen necessity arises. It is not possible at present to remove all restrictions on all imports from foreign countries because of the state of exchange, but all raw materials will be free from import restrictions.'"

From the Canadian Trade Commission in London: "Board of Trade announced yesterday removal of all restrictions on imports from British Empire."

## LESS ICE IN LAKES THAN ONE YEAR AGO

**Reports From Various Points Along the Route on the Great Lakes**

There is less ice in all the lakes than was reported last year at this period, according to the first of the 1919 reports of ice conditions on the lakes, issued in Detroit by the Marine agent of the United States Weather Bureau.

Reports from regular and display stations of the Weather Bureau and Meteorological Service of Canada indicate there is less ice in all the lakes this winter.

In Lake Superior there is a small field along the south side of Minnesota Point, which extends about eight miles along the Wisconsin shore, and also a small field off Portage Canal, and some slush ice from Point Sable east to Whitefish Point. Whitefish Bay has no ice.

In St. Mary's River the ice is reported 16.5 inches in thickness. In Green Bay the ice is 16 inches thick at Escanaba, with open water at Green Bay.

In Lake Michigan there are no fields reported, except some slush ice in the extreme southwest portion and at the Straits of Mackinac, where icefields are light and broken and drifting with the winds.

In Lake Huron there are small fields of slush ice reported over the northern portion, but none over the southern portion. In Lake St. Clair icefields are broken and the lake is practically open. Detroit River is open to Lake Erie. There are no fields reported in Lakes Erie or Ontario.

## IRON MINES AT BRIEY ARE IN GOOD CONDITION

PARIS.—Most of the iron mines in the rich Briey coal basin are in good condition and can be worked again as soon as arrangements for employing men are made, according to the report of a commission which has been making a study of the mines. But nothing remains of the gigantic manufacturing organization allied with the mines in pre-war days. Factory buildings, which it is said will take years to reconstruct, were razed by the Germans and the machinery was destroyed or removed.



# Notes on the Process of Case-Hardening

The Following Article is Reprinted From "The Machine Tool Review," Through the Courtesy of Alfred Herbert, Ltd., Coventry  
—Information of Value is Given Regarding Case Hardening

By J. R. HANDFORTH, M.Sc.

**T**HE process of case-hardening has for its primary object the production of a surface of steel which is exceedingly hard and able to withstand wear and deformation. This surface may be a few thousandths of an inch deep as for the heads of screws, to prevent burring under the action of a spanner, or it may be upwards of an inch thick, as in the hardened face of armor plate, or it may be any intermediate depth, as for plug gauges, ball races, roller bearings, etc.

The modern process consists essentially in inducing a penetration of carbon into a selected steel, by heating this steel for

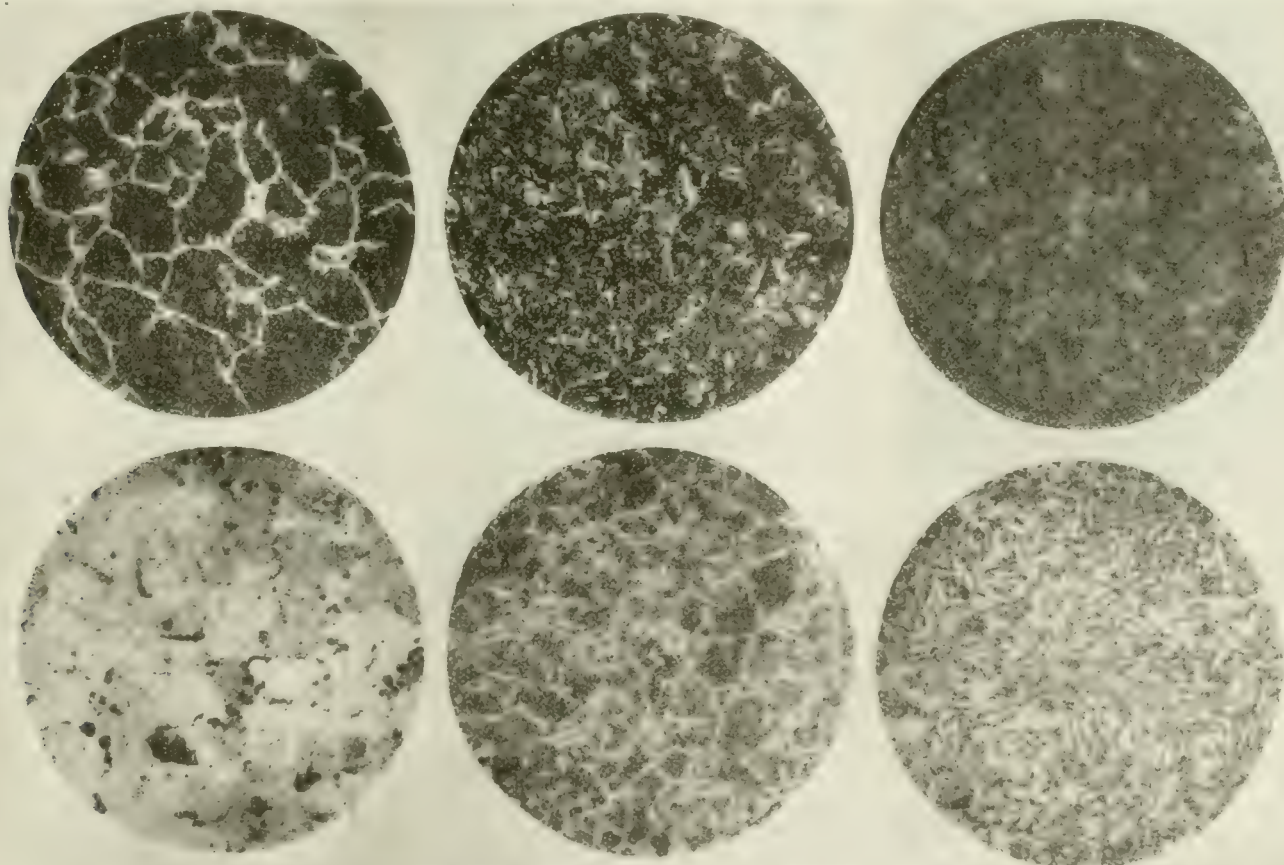
a pre-determined time at a high temperature in contact with some carbon-conveying body, which is known as the cement, and which may be either solid, liquid, or gaseous. Usually, but not universally, this operation is followed by a refining treatment, the object of which is to restore the fine crystalline grain of steel which has been destroyed by the prolonged heating at the high temperature. Finally, the carburized object is hardened by quenching in oil or water from the lowest temperature which will produce a surface of the requisite hardness.

The three main essentials for consideration are the steel used, the heat treatment, and the cement.

As the final treatment in the production of a hard surface must be some form of quenching and in the majority of cases it is requisite that the object must have some degree of toughness as

well as hardness, the choice of steels is quickly reduced to those of low carbon contents; in other words, to the steels which, when quenched in their natural state, will harden only to a limited degree. Generally speaking, therefore, a case-hardening steel should not contain more than 0.10 to 0.15 per cent. of carbon. In the best steels for this purpose the sulphur and phosphorus contents are kept very low because these elements tend to produce irregular cases with soft and shelly spots. Some doubt still exists as to what is the most advantageous amount of manganese to have present. Some experienced hardeners refuse to accept more than 0.40 per cent. of manganese, whereas others, equally well known for the excellence of their work, will not use a steel with less than 0.70 per cent. of manganese. Allowing for these differences of opinion, we may take it that an average suitable steel should contain the

\*Illustrations. The microphotographs figures 1 to 7 inclusive and figure 10 are from specimens prepared in the laboratory of Alfred Herbert Limited, Coventry, under the direction of the writer of the article. Fig. 8 is a diagram used in a number of books and articles—the author is unknown. Fig. 9 is based on data taken from D. K. Bullen's book on Steel and its Heat Treatment.



MICRO-STRUCTURES PRODUCED BY CASE HARDENING

Micro-photographs enlarged 75 diameters

The upper figures show the cases and the lower figures the cores

FIG. 1

FIG. 3

FIG. 5

FIG. 2

FIG. 4

FIG. 6

AFTER FIRST REHEAT TO 950 DEG. C AND  
QUENCHING IN WATER.  
MILD STEEL BAR CONTAINING 0.15 PER  
CENT. CARBON.

AFTER SECOND REHEAT TO 760 DEG.  
C. AND QUENCHING IN WATER.

AS TAKEN FROM CASING BOX AFTER  
SLOW COOLING.



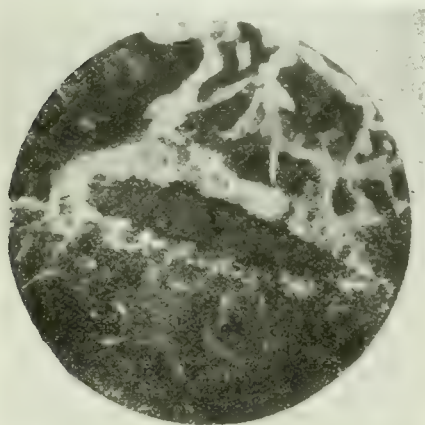
TABLE I

Composition and Physical Properties of Cores of one inch round bars case-hardened and water or oil hardened as stated from quenching at 760 degrees centigrade.

	A	B	C
Carbon	0.14	0.15	0.15
Silicon		0.17	0.17
Manganese	0.79	0.47	0.15
Sulphur		0.043	0.005
Phosphorus		0.019	0.009
Nickel		3.31	4.78
Yield point, tons per sq. in.	26.4	27.0	34.8
Max. stress, tons per sq. in.	48.4	39.9	47.8
Elongation, per cent.	28.0	28.6	22.4
Reduction of area, per cent.	73.44	46.4	46.2
Impact Ized.	75	57	45

following (percentages): Carbon 0.1 to 0.15, silicon 0.1 to 0.2, sulphur 0.05, phosphorus 0.05, manganese 0.25 to 0.8.

Assuming this to be correctly used, the



MICROPHOTOGRAPH ENLARGED 100 DIAMS.  
FIG. 7—DEFECT IN CASE. PATCH OF MANGANESE SULPHIDE.

final treatment will be to quench it in oil or water from about 760 deg. C. Under such treatment a 1 in. diameter bar of this material will have the composition and physical properties stated in column A of Table 1, and may be taken as representative of plain carbon case-hardened articles of this size.

To meet the more rigorous specifications of the automobile and airplane industries considerable improvements have been made upon the simple, straight carbon steel (A in Table 1)—in fact, from being the out-cast of the steel trade, the case-hardening steel has become one of the finest products of the steel maker's art. Of the newer steels for this purpose, the three per cent. and five per cent. nickel steels are in great demand. By the addition of nickel the tensile strength of the core is increased without reducing its toughness; with the addition of both nickel and chromium, a further increase in the tensile strength is obtained with very little sacrifice of toughness, and at the same time the hardness of the case is increased. Apart from the fact that such steels require a slightly longer time to carburize, the introduction of these elements gives rise to no serious difficulties in the operations, and, as with the plain carbon steels, the final treatment will be some form of quenching from a temperature of about 760 deg. C. Typical compositions and physical tests obtained from two of these materials are given in columns B and C of Table 1. It will be seen that these tests are a decided improvement on those obtained with the plain carbon steel in column A.

Until a few years ago it was largely believed that any kind of low carbon steel was suitable for case-hardening, and it must be acknowledged that much excellent work is turned out from cheap, basic open-hearth and Bessemer steels, whose only qualification as case-hardening steels is their low carbon content. As, however, the study of the process has progressed, it has been found that these steels have defects inherent in the processes by which they are manufactured, which makes them unsuitable for the highest class of case-hardened work. Steels produced by these processes almost inevitably contain larger amounts of slag and foreign inclusions than similar steels made in the open-hearth, crucible or electric furnace.

The illustration, Fig. 7 (Figs. 1 to 6 will be referred to later), shows very clearly the manner in which such impurities may occur and the trouble they are likely to cause. The large patch of manganese sulphide shown across the centre occurs in the case and cannot itself be hardened, while it prevents regular penetration of carbon in its vicinity. Further, it is brittle and liable to cause shelliness and flakiness, two serious difficulties. Such impurities are particularly objectionable when, as in this example, they occur near the surface of the article, for they are often not discovered until all operations have been performed and, in the production of a complicated article like a cam shaft, much time and labor may be wasted. Such a defect as this would be particularly fatal, for example, in a ball race, where it would quickly grow into a hole and cause the balls to jump and eventually break down the race.

The heat treatment in case-hardening embodies nothing out of the ordinary but it has caused some confusion of thought because of the variations which can be introduced according to the nature of the article which is being produced. Generally speaking, the operations may be summarized as follows:

(1) Heat the article to be hardened for a predetermined time at a high temperature, in contact with the carburizing mixture.

(2) Refine the grain of the steel which has been destroyed by the prolonged heating, and harden the article by quenching it in oil or water.

The aim of the first treatment is to cause a transition of carbon from the cement to the steel and in most cases this is accomplished by heating the steel surrounded by the cement in a closed box, at temperatures from 870 deg. C to 950 deg. C. It is experimentally possible to induce some carbon penetration at lower temperatures than these, but for general

work the penetration at lower temperatures is too slow and irregular. There is a minimum temperature, dependent on the carbon content of the steel being used, below which carburization should not be attempted. These temperatures for steels of various carbon contents are shown in the diagram figure 8.

If this diagram is correct, and it has been found so by many experiments, it follows that the claims that certain carburizing agents will case-harden at dull red heat are not correct; but it does not follow that some mixtures are not more effective than others at given temperatures, for, as will be shown, this is quite a fact. When the correct temperature for the first operation has been determined, the penetration of the carbon, other things being equal, will be in some measure proportional to the time during which the casing operation is continued.

Having, let us suppose successfully, carried out the first operation—that is, obtained a penetration of carbon to a required depth, it remains to determine what shall be the subsequent treatment of the article to produce the best possible result, and it is on this subsequent treatment that successful practice largely depends. The various alternatives have been admirably summarized as follows by the Society of the American Testing Association:

"(1) When hardness of the case only is desired, and lack of toughness is unimportant, the carburized objects may be quenched directly from the boxes into oil or water. Under these conditions both the core and the case are coarsely crystalline.

"(2) To reduce the danger from cracking and distortion, the objects may be removed from the box and allowed to cool to about 800 deg. C. before quenching. This also leaves both the core and the case coarsely crystalline.

"(3) If the object is cooled from the box to below 700 deg. C. and reheated to 760 deg. to 800 deg. C., followed by quenching in oil or water, the case will be refined, but the core will remain coarse.

"(4) To refine both the core and the case the objects should be cooled slowly

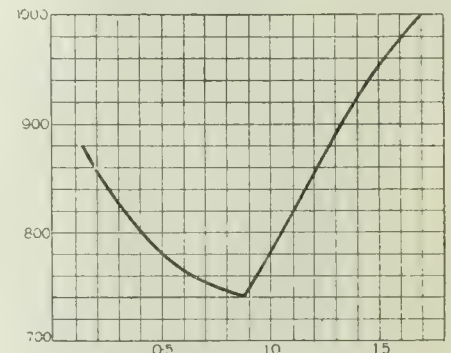


FIG. 8 EQUILIBRIUM DIAGRAM  
VERTICAL LINES INDICATE CARBON CONTENT (PERCENTAGES) OF STEELS. HORIZONTAL LINES INDICATE TEMPERATURES IN DEGREES C

to below 700 deg. C. and then:

"(a) Reheated to 900 to 950 deg. C. and quenched in oil or water, and

"(b) Before they have cooled below 100 deg. C. they should be reheated to



760 to 780 deg. C. and again quenched in oil or water.

"(5) To reduce hardening stresses and to impart a further degree of toughness, they may be tempered by reheating to 200 deg. C."

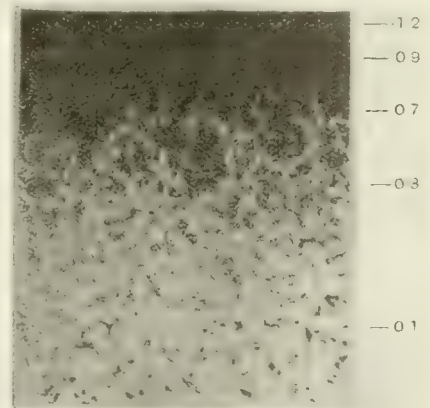
We shall now endeavor to explain the fundamental principles on which the above summary is based. To do this, it will simplify matters considerably to get an accurate mental picture of the condition of the article at the end of the first process. We started with, let us say, a mild steel bar containing 0.15 per cent. of carbon. Surrounding this, and more perfectly connected to it than by the most ideal weld, we have placed a thin layer of high carbon steel, similar in carbon content to the steel used in the manufacture of taps or reamers, and finally, these have been soaked together for a number of hours at a very high temperature and allowed to cool slowly. Anybody with the slightest experience of hardening practice can picture the type of coarse fracture which would be obtained from a high carbon steel when broken after soaking in a furnace for six to nine hours at 900 deg. C. This is exactly the type of fracture which is obtained if an article is broken as it is taken directly from the box, or if, as recommended in paragraph (1) of the above summary, it is quenched without further treatment. The coarseness of the grain structure of such articles is shown by the microphotographs (Figs. 1 and 2). Fig. 1 shows at 75 magnifications the high carbon case with the large cell structure of hard and brittle membranes

mounted by using the method of "double quenching," in which the grain of the mild steel core is first refined and afterwards the grain of the high carbon case is refined. To refine the mild steel core, the carburized object is heated for about ten minutes to a temperature just above that at which it was case-hardened and it is then quenched in oil or water. By this reheating, the large crystals which were formed by the long soaking of the previous treatment are broken down into a great number of smaller ones, and the pearlite of the core, which was previously segregated into large masses, is now uniformly distributed through the steel, and held in this condition by quenching. The change which takes place in the core can be seen in Fig. 4, remembering, of course, that the steel is now being viewed in the quenched condition, not in the slowly cooled condition as seen in Fig. 2.

It will immediately strike the observer that the treatment for the core is not suitable for the case, as no sane hardener would suggest quenching 1.0 per cent. carbon steel from 920 deg. C. in water. This high temperature, however, has a beneficial effect on the case as well, as will be seen from Fig. 3, which is again a photograph of the case. In practically all commercial case-hardening, unless special precautions such as those indicated below are taken, the case always contains more than 0.9 per cent. of carbon, and has therefore a considerable portion of free cementite. This is for the white substance shown in Fig. 1. It is glass hard and glass brittle, and on slow cooling it separates in the steel into dangerously thick cell walls, which are not destroyed at the usual temperatures for the ordinary hardening of 0.9 to 1.0 per cent. carbon steel. These membranes are, however, largely broken down by reheating to 920 deg. C., which causes them to pass into solution in the steel, and the sudden cooling retains them in this condition. The hardness of the case can, to a certain extent, be regulated by the amount of free cementite which is allowed to remain in the massive form, provided, of course, that its distribution is properly arranged so as to ensure freedom from the danger of flaking. In Fig. 3 a considerable proportion has been left in this form, but it is evident that its distribution is now much more uniform, and that the case in this condition is considerably safer than in that shown in Fig. 1.

Having refined the core and partially improved the case, a final treatment is necessary to give the case its finest possible grain size. This is done by reheating to 760 deg. C. and quenching again in water or oil as desired. The same principle is again involved, i.e., that reheating the high carbon case to 760 deg. C. breaks down the large grain produced in the case at 920 deg. C., and the quenching retains the steel in this desired structure. Fig. 5 shows a portion of the case after this treatment, and it is interesting to compare it with Fig. 1 and note the refinement which has taken place. This final treatment has practically no effect on the grain size of the core, but owing to a change which takes place in the nature of the constituents

of the core the steel is left in the very tough and fibrous condition shown in Fig. 6. In objects where toughness is not a primary requisite, the second treat-



MICROPHOTOGRAPH ENLARGED 100 DIAMS. FIG. 10 THE FIGURES AT THE SIDE INDICATE THE PERCENTAGES OF CARBON AT VARIOUS DEPTHS OF CASE

ment, by which the grain size of the core is refined, may be omitted without detriment. In such practice, however, precautions should be taken during carburizing to prevent the formation of large membranes of cementite, which, as shown above, require the high temperature quenching for their removal. This can be done by ensuring that the carbon content of the case is not allowed to exceed 0.9 per cent., for under such conditions no free cementite will separate, and the one simple low temperature quenching will give a fine grained case free from the danger of flaking. The factors responsible for the production of cementite in the case are the temperatures at which the carburizing operation is carried out and the cementing mixture which is used in the process. These factors are obviously controllable, and as they are interdependent they will be considered together in a general discussion of case-hardening compounds.

As the first essential of case-hardening is to induce a penetration of carbon into a steel, it would be thought that the cheapest way of doing this would be to heat up the steel along with some form of carbon, such as charcoal, coke, or graphite. Cementation can indeed be carried out in this manner, but it is very quickly found that carbon in its simple forms is one of the least efficient of the many substances which can be used, and the penetration obtained from it is remarkably small. Another fact which has been proved time after time, but which is not sufficiently realized by many case-hardeners, is that the penetration of carbon is much more dependent on the gases which are present in the box than on the actual contact of the steel with the cement. An article may be completely buried in sand, but, provided there is plenty of cement in the box, and the box is well luted to prevent the escape of gases, it will be carburized almost as efficiently as if it were packed round with the cement itself. The modern mixtures, therefore, are more or less complex carbonaceous substances, which, on heating to high temperatures,

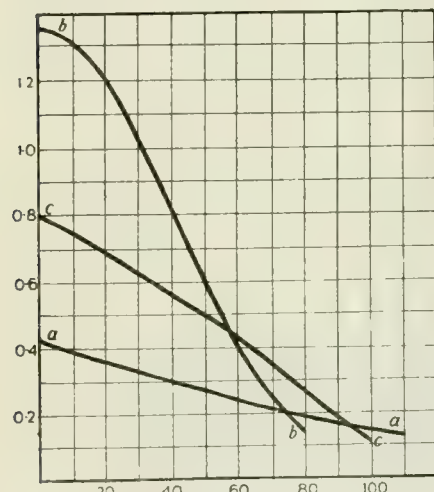


FIG. 9—DIFFERENT TYPES OF PENETRATION OBTAINED WITH DIFFERENT CEMENTS.

Vertical lines indicate depth of penetration, the figures at foot representing thousandths of an inch; i.e., 0.020-in. to 0.100-in. Horizontal lines indicate the percentage of carbon in the case at the various depths.

of cementite as they occur in a specimen cooled in the box. Fig. 2 shows at the same magnification the structure of the core in which the various constituents are gathered into large, irregularly distributed masses. The problem of refining the structure of such an article is complicated to some extent by the fact that we have to deal at one and the same time with steels of high and low carbon content, which would, if treated separately, be refined at different temperatures. This difficulty is most effectually sur-



evolve carbon-containing gases. Of the substances to be found in such mixtures we might mention wood-charcoal, burnt leather, burnt bones, barium-carbonate, organic residues from dye works, spent charcoal from sugar refining, soda ash, heavy oils, etc.

In studying such mixtures there are three well known ways in which we may obtain an idea of their nature and value. The first and simplest of these is to carburize a bar under standard conditions with the mixture under test, and from this bar turn successive layers of a definite depth, say one thousandth of an inch, and have these turnings analyzed for carbon. If the figures so obtained are plotted in the form of a curve, as in Fig. 9, we get an impression not only of the amount of carbon which has entered the bar, but also of the manner in which this carbon is distributed in the bar. Thus, two mixtures A and B, under identical conditions, might give us the results illustrated by the curves (a) and (b). These show that mixture A has carburized the steel to a greater depth than mixture B, but that the penetration falls off slowly and regularly, while mixture B causes a high concentration of the carbon at the surface, but there is a rapid decline in the concentration of carbon from the exterior to the interior of the bar.

This method is valuable, but it is slow and laborious, and we can get a quicker idea of the depth of penetration by examining the fracture of a case-hardened bar after it has been refined at 760 deg. C. This, however, does not show us the distribution of the carbon in the steel, which for many purposes is as important as the depth of penetration. If, however, a section of the fractured bar is polished and examined under the microscope, a perfect picture of the distribution of the carbon can be obtained showing depth and concentration, and a photograph similar to Fig. 10 would give a permanent record.

The importance of the evolved gases has been emphasized. If the amounts of these gases which are liberated at 870 to 950 deg. C. are measured, they give another excellent indication of the value of the cementing mixture. This is quite a laboratory job, and even then it is long and tedious. It serves, however, two very useful purposes. It puts out of the field the mixtures containing large amounts of water or heavy oils. Both these substances are detrimental from the fact that they take additional fuel to heat them, and they give off copious amounts of gases at temperatures below which casing can occur, and by so doing they destroy the luting of the boxes and allow the escape of the useful gases which are evolved at higher temperatures. This method can also be used with effect to test those mixtures which are said to be regenerative and to give the same penetrations at the third or fourth time of using.

From careful experiments made upon these lines, especially from experiments made on cementation by gas, it has been possible to divide case-hardening

compounds into two broad groups. These are the "gradual" or carbon monoxide type and the "sudden" or hydrocarbon type. The difference between the two is illustrated in the curves (a) and (b), Fig. 9. In the "gradual" type of cement the maximum amount of carbon in the case is low but the penetration is deep, and the concentration falls off progressively. With the "sudden" or hydrocarbon cements, of which ethylene is an example, the carbon content at the surface is high, but the concentration rapidly falls away and the penetration is not deep. Each type of case has its advantages. In gaseous cements, and to some extent in solid cements, the resulting type of case can be controlled at will. Thus, by the addition of a small amount of ethylene to carbon-monoxide, a penetration like that shown in curve (c), Fig. 9, can be obtained which combines the advantages of both types.

The majority of solid cements belong to the sudden or hydrocarbon type. Potassium cyanide, which is used as a molten bath or in the form of a "sprinkling powder," to give cases a few thousandths of an inch deep, is an excellent example of a "sudden" cement. Of the "gradual" solid cements, wood charcoal is perhaps the most effective, especially if deep penetrations, which can be obtained by long soaking, are required. Animal charcoal belongs to the "sudden" class on account of the hydrocarbons it evolves when heated, so that mixtures of wood and animal charcoal can be used with some success to control the type of case desired. The standard mixture of barium carbonate and wood charcoal may be either a gradual or a sudden cement according to the temperature at which it is used. At low temperatures it gives low carbon concentration and somewhat thin cases, whilst at high temperatures it gives thick cases and high carbon concentration, so that by varying the conditions this cement can be made to serve different purposes. This is a valuable property in a cement, but it is not necessarily good practice to have to raise the temperature to increase the depth of the case.

A somewhat frequent trouble which arises from the use of a poor cementing mixture is the occurrence of soft or shelly spots in the case, probably due to high sulphur and phosphorus contents. Cements which contain large percentages of these elements sometimes contaminate the steels with the above results. Barium carbonate mixtures, for example, may contain free sulphur or barium sulphate, while mixtures containing burnt bones inevitably contain a large amount of phosphorus in the form of calcium phosphate, which, at the high temperatures of the casing operation, is quite capable of passing on some of its phosphorus to the steel.

From these considerations it will be seen that the selection of a case-hardening mixture allows room for a considerable amount of discretion. When a definite type of case is required a definite type of cement can be chosen, and when these have been decided upon the

requisite heat treatment can be readily found by application of the principles outlined above.

## CANADIAN PLANTS WILL HAVE A VOTE

International Harvester Co. Has Plans  
Out For Starting a Novel  
Scheme

Chicago.—The International Harvester Company announced lately that its 30,000 employees will take a secret ballot on Wednesday on the question of adopting an "industrial council" plan giving the workers an equal voice with the management in shaping company policies pertaining to working conditions, wages, and all other matters of mutual interest.

In announcing details of the plan, which provides that no employee shall be discriminated against because of "race, sex, political or religious affiliation or membership in any labor or other organization," the company stated that the underlying object is to establish relations between worker and management "upon a definite and durable basis of mutual understanding and confidence."

Each of the 17 American and three Canadian plants will vote on the question and the plan will become operative at plants where it receives a majority vote. Under the plan, a "works council" will be established at each plant composed of not less than five representatives nominated and elected from the ranks of the employees and a like number appointed by the management. The two groups will have equal voting power on all questions; they will vote separately and according to the unit rule.

## GUELPH INDUSTRIES ARE GROWING NICELY

GUELPH.—From present indications Guelph is in for an industrial boom which bids fair to exceed all former records, as several new industries have already decided to locate here, and there are prospects for several other good ones.

At the meeting of the Directors of the International Malleable Iron Company, here this week, it was decided to proceed at once with the erection of a new factory three stories high, 160 by 60 feet, in addition to their already large plant. The new building will be used for the manufacture of pipe-fittings for the foreign and domestic trade, and will provide employment for at least 100 men to start. The work of construction will begin as soon as the plans are confirmed and the contracts let.

Another new industry which will start at once is the Lang Machinery Company, which has leased the large factory building on Suffolk street owned by the city for a period of five years, and will carry on a general machinery business. The company is capitalized at \$100,000, of which \$40,000 is paid-up.



# Some Recent Applications of Arc Welding

Various Methods in Use—Explanation of Process—Building Up Worn Surfaces—Cutting Risers Off Castings—Some Illustrations of Work Done by the Aid of the Arc Welder

By FRANK C. PERKINS

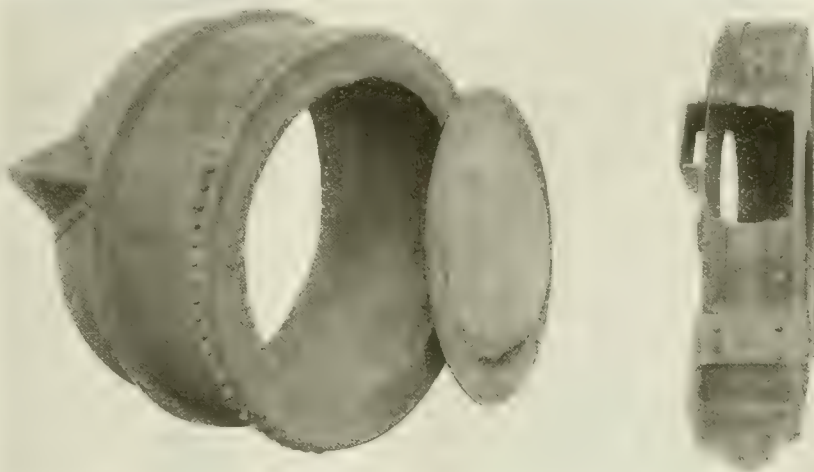
**T**HE term "Electric Arc Welding" in its present day sense is a general term applying to three more or less distinct processes, after the men who are generally credited with developing them, namely Bernardos, Slavianoff and Zerener. The Bernardos process is the best known and the most extensively used, and is especially adapted for large and heavy work. It consists of drawing the arc between the work and a single carbon or graphite electrode and is, therefore, commonly known as carbon electrode welding. The arc is drawn by touching the electrode to the work and withdrawing it to the proper distance in a manner similar to the action of an arc lamp when starting.

It is of interest to note that the temperature of the arc is approximately 3,500 deg. C. and the heat is confined to a comparatively small place directly in contact with the arc. The intense heat of the arc, on striking the filling metal, causes it to melt rapidly and flow into place, and as the arc is moved over the work the filling metal and the molten metal of the work unite in an intimate mixture or weld. The use of a small electrode with low current values allows the use of this process in welding comparatively light material, but the principal use is with larger electrodes and heavier currents for heavy work.

In welding by this process attempts were made at first to use the carbon electrode as the positive terminal and the work as the negative. This was

found to be unsatisfactory because particles of carbon from the electrode were carried into the weld, making it exceedingly hard, and therefore difficult to machine. Consequently it is now considered advisable to always connect the work to the positive side of the circuit

The Zerener process consists of an arrangement of the positive and negative carbon electrodes in a holder so that they form a "V," the arc being between the poles of a powerful electro-magnet which forces the arc toward the work. This causes the arc to act in a manner



COMPOUND KETTLE AND NEW BOTTOM PLATE READY FOR WELDING

DEFECTIVE GEAR CASE READY FOR WELDING

and the electrode to the negative. An additional fact in favor of this method is that the greater portion of the heat of an arc is concentrated at the positive terminal.

The Slavianoff process is commonly known as metallic welding since it consists in using the work as one electrode and a piece of filling-in material as the other, the latter being held in a suitable holder similar to that used for the graphite electrode. The arc is drawn by touching the work with the metal electrode and drawing it away as previously described, but the filling-in is accomplished by the melting away of the electrode itself. In general this method will make a softer weld than the Bernardos process, since there is no tendency for carbon to be carried into the weld, because of the action of the arc in carrying the metal from the electrode to the work, it is possible to weld on a vertical wall or overhead. This method of operation is largely used in such work as overhead repairs in the firebox, and welding flues in locomotive boilers in railroad shops, and is of great value where repairs must be made in place.

similar to the flame of a gas torch, but because it is sensitive, inefficient and complicated, this process is not used as extensively as the Bernardos and Slavianoff processes. This process is used to a limited extent for comparatively small work in steel and brass and for welding small corners in tubes and tanks.

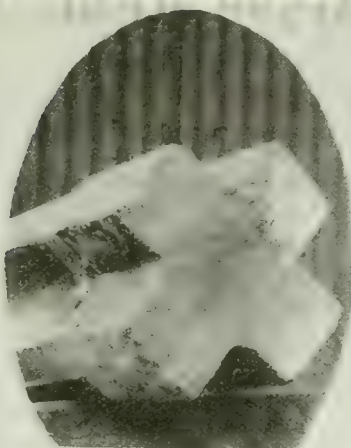
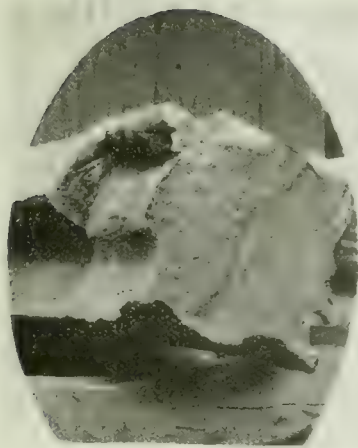
The direct current arc is practically steady, the temperature obtained is high (approximately 3,500 deg. C. at the positive electrode), and the heat generated at the positive terminal is approximately 75 per cent. of the total heat generated in the arc. Modern welding by means of the electric arc is accomplished by fusing the surfaces to be welded by means of the high temperature of the arc and then filling in with additional material which is also melted. This in effect is really a method of casting and unlike other forms of welding, the use of mechanical means in causing the parts to unite is unnecessary.

In some instances the joint is hammered while hot, but this is only for the purpose of increasing the ductility of the metal. When the carbon electrode is used, the filling metal is fed into the arc by the operator at a rate depending on the work being done. On the other hand the metallic electrode itself forms the filling material, being melted away and deposited on the work in the form of minute fluid particles.



DEFECTIVE BOTTOM PLATE IN COMPOUND KETTLE





BADLY WORN STEEL MILL ROLL REPAIRED BY ELECTRIC WELDING

In every instance the metal on which the welding is to be done is connected to one side of the circuit and the electrode by means of a suitable holder is connected to the other. Of course the controlling equipment, including protective and regulating devices must be included. The electrode is connected to the negative side of the circuit and the work to the positive for the reason, previously given, that the greater amount of heat is generated at the positive terminal—this prevents a too rapid consumption of the electrode. Furthermore, carbon from a graphite electrode is prevented to a great degree from being carried over into the work, and thus hard welds are largely eliminated. The fact that the greater part of the heat is liberated at the positive electrode means that the work directly in contact with the arc is quickly brought to a high temperature and locally to a state of fusion, which makes possible very rapid welding by this means.

In this form of electric arc welding the arc is established by momentarily touching the electrode to the work and then withdrawing it a short distance, in a manner similar to the operation of an arc lamp in starting. Practice is necessary in order to manipulate the electrode so as to maintain an approximately constant length of arc while welding. This point is important as variations in the length of the arc cause corresponding variations in the current, which in turn cause variations in quality and uniformity of the metal in the weld.

The carbon is considerably longer than the metallic arc and is, therefore, more stable and less liable to break. The metallic arc is extremely short, being only from one-eighth to one-fourth of an inch long. After the arc is established it can be moved about over the work by merely moving the electrode. The carbon electrode can be used to preheat the work, extending the heating to a distance from the weld by keeping the electrode moving rapidly enough to melt the work. In the working with the graphite electrodes there must be a potential across the arc of from 35 to 50 volts, depending on the current being used. The current varies from 200 amperes up, depending on the

type of work being done. In light work, small electrodes and current values less than 200 amp. can be used. The average type of welding done by this method will require from 300 to 400 amp.

#### Cutting

The electric arc cuts very rapidly, because the heat is concentrated on a small area. To cut more rapidly, all that is necessary is an increase in current on the circuit being used. By using the graphite electrode and 400 to 600 amp., a 4 in. by 4 in. riser on a casting can be cut in four minutes at a cost of only five cents. In welding with the carbon electrode, the operator holds the electrode holder in one hand, and feeds a rod of filling material into the arc with the other. This filling material is melted into the weld and mixes with the molten metal of the work, forming a homogeneous mass of metal in the weld.

This method is largely used for building up worn surfaces, owing to the rapidity with which a large amount of metal can be built up. Welding with the metallic electrode requires much lower current values than those used with the carbon electrode. Currents as low as 15 amp. are used and the upper limit is about 200 amp. The voltage at the arc is only from 20 to 25 volts. The metallic electrode can be used on much lighter stock than can the carbon electrode. It requires greater ability on

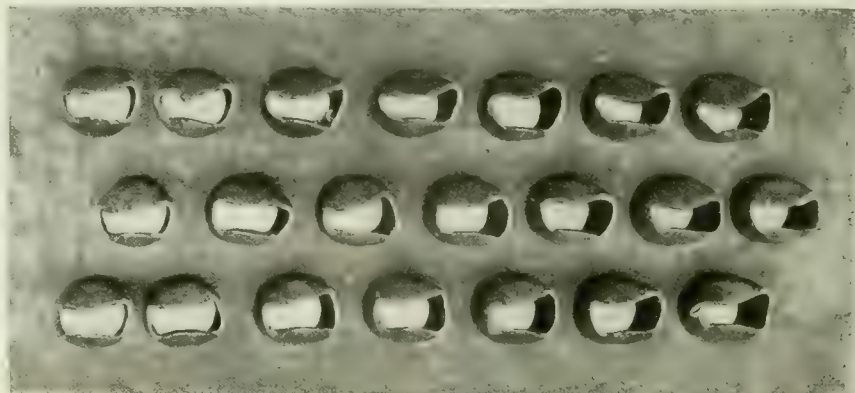
the part of the operator, however, on account of the shortness of the arc and the consequent difficulty of maintaining it.

The arc is more unstable than the carbon arc, and the operation is somewhat more difficult to master, but this is compensated for by the fact that certain classes of welding that are possible by this method cannot be done by any other process. Among these is welding overhead or on vertical surfaces previously mentioned. Further, there is no possibility of carbon being carried into the weld. Cast and malleable iron can be successfully welded by the electric arc provided certain precautions are taken. For this type of welding the work should be preheated either by the use of the carbon electrode or by means of gas, coal or oil fires.

It is held that the work should be brought up to a red heat and the heat carried well back from the weld or cooling strains and probably cracks will follow. The work should be kept hot during the time the weld is being made. Flux is of great assistance in welding cast iron. One commonly used consists of a mixture of borax and red oxide of iron. The borax should be heated to drive out the water of crystallization before using the flux. This mixture is supposed to prevent carbon entering the weld, and also to keep the surface of the metal in the weld clean and so permit a better union of the metal.

Very thin sheet metal can be welded by using the metallic electrode with low current values. The cost of welding seams in  $\frac{1}{4}$  in. plates by the electric arc method would be 5 cents per foot and eighteen feet of seam can be welded an hour.

Regarding the welding equipment, any direct current source can be used for arc welding, but the voltage must be reduced to the values previously given of from 10 to 50 volts. This is done by inserting resistance in series with the arc to absorb the excess voltage. This is plainly a very inefficient method of operation as the voltage absorbed by the rheostats is energy wasted. If the supply circuit is 250 volts and the arc requires 50 volts, it is obvious that four-fifths of the energy taken from the



TWO-INCH TUBES ELECTRIC ARC WELDED INTO  $\frac{1}{4}$ -INCH BOILER PLATE, SHOWING BATTERED TUBES. NO OIL LEAKS PRODUCED.



mains is wasted in the rheostat. If, now, the supply circuit is 550 volts and the metallic arc is being used at 10 volts, the energy used is only a very small fraction of the energy taken from the line.

In order to avoid these losses a number of firms have developed a line of special low-voltage generators and a method of control, which give the maximum of efficiency, combined with flexibility and protection. That made by the General Electric Co. has a generator wound for a voltage of from 60 to 75 volts and in no case is it necessary to

welding circuit can be regulated to suit the work in hand by adjustment of the generator field rheostat. The control consists of a main generator panel and a separate panel for each operator. Double-circuit panels can be provided so that two operators can work from the same panel through separate equipments. If the circuits are duplicates a set of switches can be provided for connecting the entire capacity of both circuits to one electrode. This can be used for carbon electrode welding.

A convenient type of switch has been devised for adjusting the resistance in series with the arc and providing a number of steps in changing the current. If an operator leaves his electrode in contact with the work longer than necessary to start the arc, a relay on his panel operates and introduces additional resistance in series with the electrode, thus reducing the current to a low value. To restore these circuits to the normal condition and to resume working, it is necessary only to remove the electrode from the work and break the circuit. By this means, a large number of operators can work from the same machine, since trouble on any one operating circuit is localized and does not affect any other.

It may be of interest to consider some of the advantages of arc welding. The electric arc provides a very high temperature which may be confined to a small area. By this means the work is brought to a fusing temperature before the heat can be carried off through the metal of the work by conduction. Provision for the storage of gas, carbide, or other material of that nature, is unnecessary.

The electric arc equipment is simple and is easily understood by the operators. Since no combustible or explosive material is used in this process, there is practically no danger of explosion or fire. The use of the metal electrode permits of overhead welding, which is impossible with other processes. The equipment is very flexible since various kinds of work can be done with no change in equipment.

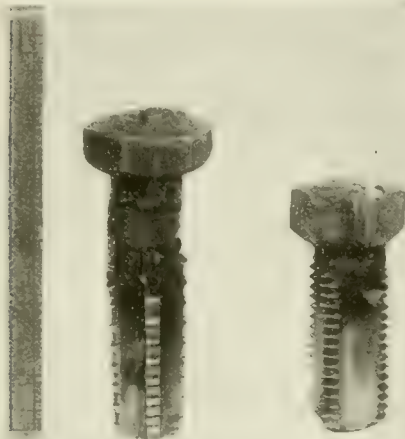
As most large steel plants generate

their own electric power, and since the current consumption by an electric welding outfit is comparatively small, it will readily be seen that compared with gas or resistance outfits for welding, the cost of operating an electric outfit will be very low and will result in a considerable saving.

Some of the special applications of arc welding in steel mills, foundries, and machine shops may be of interest. Steel companies having electric arc welding equipment have found that much of the material formerly scrapped, such as cracked shafts, rolls with worn wobblers, rolls worn in the passes, cracked spindles, cracked ladles, cracked rolling mill machinery, etc., can be successfully welded and rendered practically as good as when new. The welding of annealing boxes with the electric arc is not only successful but is the cheapest method for making those boxes; furthermore, they withstand the expansion and contraction more successfully than boxes welded either by hand or by gas.

Strong and homogeneous welds are successfully made in large sections, such as locomotive frames, driving wheel spokes and the welding of flue sheets, fire boxes, etc. Repairs and welds in the steel work can be quickly made by this method. Welded joints can safely be substituted for riveted joints in tank cars, etc., and in passenger and freight cars, practically any of the metal work can be repaired by the arc. This includes repairs to the bolsters, trucks, framing, piping and air brake equipment. The use of steel cars is becoming more general throughout the country, and the repair of frames, siding, roofs, piping and trimmings, as well as the heavier parts, is best accomplished by the modern electric arc welding process.

It is possible to weld pipes into complicated forms and to obtain great strength in the joints. Special pipe fittings with the attendant leakage are eliminated and a better appearance and arrangement can often be made in an extensive piping system by the use of such welded pipe.



BROKEN TAPS REMOVED BY ARC WELDING

have a generator of higher voltage than this for welding. Lower voltage may occasionally be used with very low current values. The generators are usually furnished as part of a motor-generator set, although they can be furnished for belt drive if desired. The motor-generator set is the most desirable equipment for several reasons. It is self-contained unit, does not demand constant attention when running, and the maintenance cost is low.

The welding circuits and the shop circuits should be electrically independent so that short circuits in the welding circuit will not seriously interfere with the shop circuits. The voltage on the



3-16-IN. PLATE SMOKESTACK ELECTRIC ARC WELDED JOINTS



ANNEALING BOX SHOWING BURNED IN CORNER, RIVET HEADS BURNED OFF AND PLATES SPRUNG APART AT JOINTS, BEFORE WELDING.





## WHAT OUR READERS THINK AND DO



*Views and Opinions Regarding Industrial Developments, Factory Administration and Allied Topics Relating to Engineering Activity*

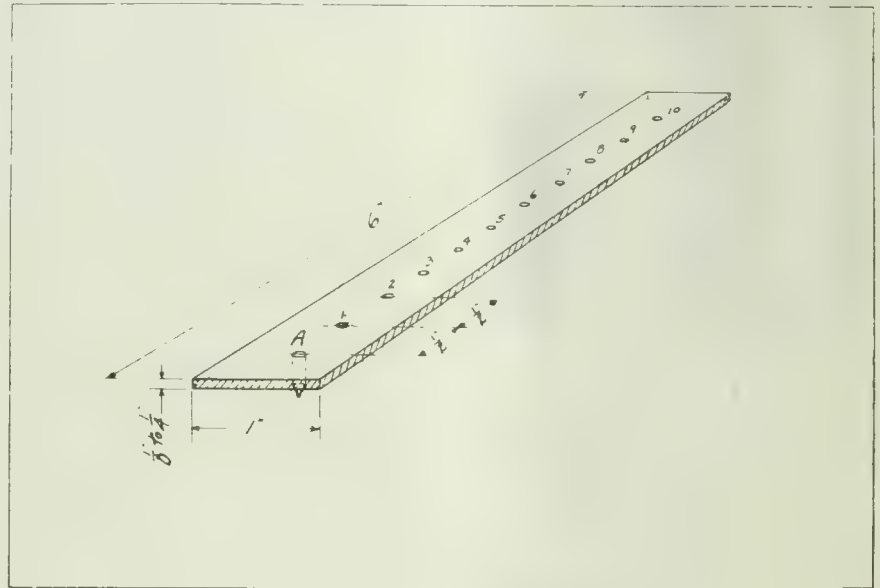
### WOOD-WORKING KNIFE GRINDER

By J. H. M.

IT sometimes happens that in passing through a shop of any kind, one can rest one's eye on a fixture, that at first glance looks too simple to be worthy of a second glance, yet the more it is thought over, the more apparent it becomes that the very simplicity of the idea was its greatest asset.

The illustration accompanying this article, denotes just such a case. At first glance the simplicity looks a drawback, then, on second thought, its simple design makes it the more useful. The operation is the regrinding of knives for wood-working machinery, the machine used for the operation being an ordinary floor grinder with a wheel about 18 to 20-in. diameter.

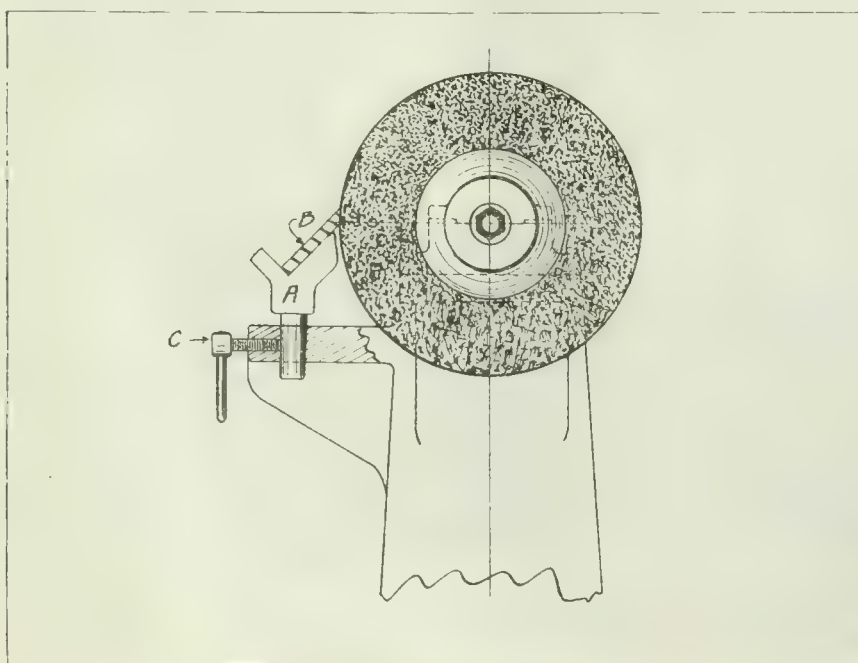
The holder A is shaped at correct angle to suit the angle desired on the knife edge. Knife is then placed on this holder in the manner shown on sketch, and run over the wheel until edge is of desired keenness. The binder screw C holds the portion A in place by the round shank made to suit the particular size of hole on rest of the grinder used on operation.



CIRCLE SKETCHING SCALE

B represents the blade in place, and as the rest of the operation is so self apparent no further comment is made, except

to say that for very slight cost one can grind one's own wood-working blades, or others of similar design. Naturally it is imperative that wheel be kept in good condition to complete such work satisfactorily, but this is an obvious point, for no good work can be accomplished with a poorly-dressed wheel.



WOODWORKING KNIFE GRINDER

### CIRCLE SKETCHING SCALE

By J. H. M.

How often has the draftsman, yes and even the machinist, not to speak of the humble apprentice, wished for some simple method to draw circles without the aid of a compass! Its hardly necessary to say quite often, for we have all been of the same opinion at times, when just as we wished to make a sketch, and did not have a pair of compasses handy, oh what a circle we made! I'll bet in some cases it looked more like a octagon than a circle.

The writer decided such a state of affairs must stop, and he got busy thinking up the matter with the result shown on accompanying sketch.

Making a board of 3/16-in. thickness, one inch width, and six inches long, he proceeded to drill small holes every half-



inch right down to centre as shown. He made these holes just large enough to allow the point of a pencil to go through.

At the first hole, namely A, he inserted permanently a graphophone needle, but left all other holes free. In use this board, or scale as we might call it, is indispensable, for to draw a circle, all that is necessary is to place the needle on the paper, place your pencil through the hole desired, and revolve the scale around. Result is a splendid circle at a moment's notice.

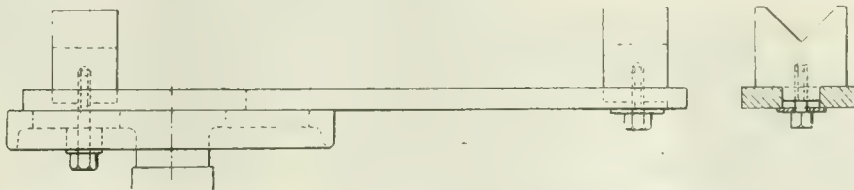
For example, we will suppose it is desired to draw a circle 5-in. diameter. Place pencil in hole No. 5, namely  $2\frac{1}{2}$ -in. from the needle, revolve the scale, and there you are with your required circle in short order. Readers will do well to make one of these scales, for they can be carried in the vest pocket with no inconvenience, and are a handy thing to have around.

### DRAFTSMAN'S KNIFE WITH DUAL FUNCTION



WHEN a knife is used for erasing, its edge needs to be kept in the finest condition in order to scratch out the lines with the minimum removal of material and risk of damage to the drawing or tracing. A device for securing this end is seen here, and consists in marking the halves of the blade by grinding out a slight concavity in the middle, and then using the outer half of the blade for erasing, and the inner half for sharpening pencils, etc. The concavity can also, if wished, be used for putting the finishing touch on the points.—FRED HORNER.

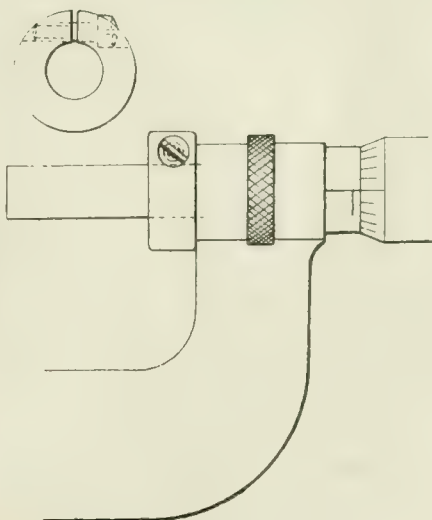
### EXTENSION TABLE FOR SENSITIVE DRILLING MACHINE



THE extension table shown is designed to carry long spindles and shafts on the small round table of a sensitive drill, so that these can be held and steadied by the hand in the vee-blocks, without any necessity to clamp them down. It is necessary to do so if the weight of a spindle overhangs the table sufficiently to

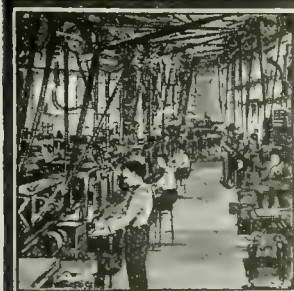
cause tipping. The extension consists of a slotted plate, carrying the vee-blocks by tongues in the slot. The outer block is secured at any desired position by the set-screw and washer, while the other block is held with a screw that also serves to hold the table down to the main one.—FRED HORNER.

### STOP-COLLAR FOR MICROMETER SPINDLE

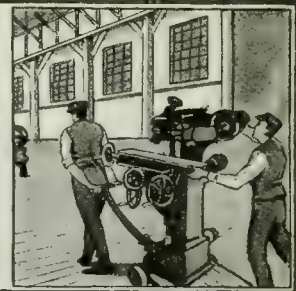


A GOOD deal of time is wasted when making repetition tests of mike dimensions, by the user turning the thimble back much too far each time, so wasting time and giving the eyes trouble in working back to the desired graduations. A means of avoiding this waste may be observed from the figure: a fibre collar is turned up and fitted with a screw to draw it tight round the spindle. This acts as a check after the thimble has been turned back three or four thousandths, and keeps it within sensible limitations.—FRED HORNER.





## DEVELOPMENTS IN SHOP EQUIPMENT



*Makers of equipment and devices for use in machine shop and metal working plants should submit descriptions and illustrations to Editorial Department for review in this section.*

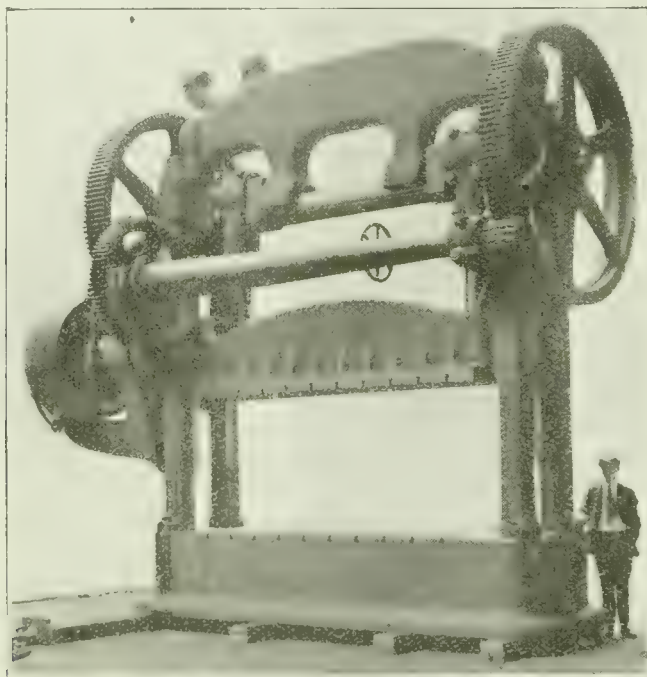
### LARGE PRESS

THE Ferracute Machine Company of Bridgeton, New Jersey, has built the press shown in the accompanying illustration. The machine is what is known as Press S507, designed for pressures up to 500 tons. The tensile stresses are taken by four 5½-inch steel rods that are shrunk in the cast iron columns. The ram has a vertical motion of 18 inches and makes be-

shaft, a construction which the manufacturers believe to be unique. The reason for having this shaft a large diameter at its driven end is to equalize the torsion so that both the large gears will be driven with equal pressure, tangentially, upon their teeth. This is accomplished by the short part of the shaft at the left being elastically twisted only to the same degree of rotation as is the long part at the right, which, if the

press was under construction, it being essential that all the journals of the clutch shaft should be exactly aligned. Placing the gear at one end and giving scientific proportions to the shaft, obviates the objections mentioned. It also enables the clutch-shaft to be much shorter than by the old design, and uniformly of standard length.

The total weight of the press is about 137,000 lbs.



LARGE POWER PRESS

tween five and six strokes per minute. The distance between columns, right to left, is 148 inches, and from bed to ram at top of stroke and adjustment, 60 inches. Power is applied through the medium of a combined friction-clutch and brake, by means of which the operator is given complete control of the action, it being possible to start or stop the press at any part of the stroke—or, to run continuously—or, to have ram stop automatically at top of stroke each time.

Provision is made for attaching a motor-shelf at the top of the press.

Attention is called to the tapered back

shaft were parallel the whole length, would of course twist much more on account of its length than would the short section. As the torsional deflection of a shaft under stress is inversely as the fourth-power of its diameter, the proper amount of taper required to produce the desired result is easily calculated.

A method formerly used to insure equal pressures at the ends of the back-shaft was to place the driving gear in the middle of the shaft, but this involved a somewhat unwieldy outrigger or bracket to carry the journal box of the clutch-shaft and required great care in the mechanical operations when the

### A POWERFUL ELECTRIC ROTARY SHEAR

The accompanying illustration shows an electric rotary shear, developed at St. Marys, Ohio, which does in one operation with one handling of the material work that has heretofore required several machines, some hand work and all the consequent handlings of material.

It is pointed out that no class of industries have grown and developed so rapidly as those using plate and sheet metal, but machines and methods for handling this class of work have not been correspondingly developed. The first and most important operation in the working of plate and sheet metal for any purpose is the cutting of it to the required sizes and shapes, and the ordinary methods of cutting are so slow, crude and inadequate that the need for improvement in cutting machines has become acute.

It is claimed that this electrically driven machine requires less metal, fewer men, and makes it easy and profitable to do work that it is not practical to cut by any other means excepting blanking dies in a press.

Metal is saved because in cutting a number of small parts from a large sheet, the parts can be scribed close together on the sheet, and the lines cut, the parts being finished at one passage of the metal, no allowance being made for roughing off and consequent wastage preliminary to making the finished cut as is necessary with old methods.

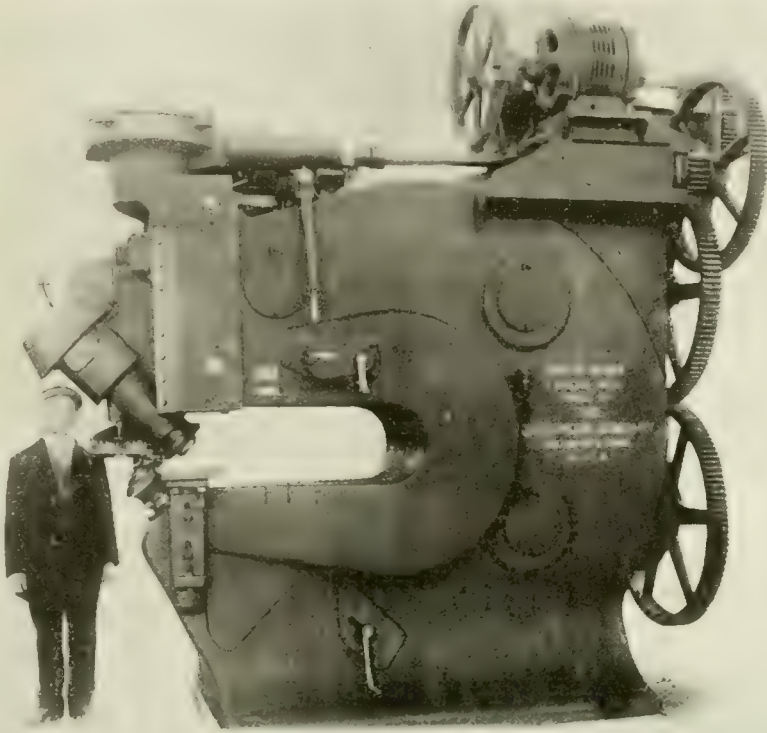
It is held that it will shear straight lines in a plate of steel quicker than older methods excepting a long-bladed squaring shear or gate shear that cuts the full length of the sheet at one stroke. As compared with cutting with the ordinary types of horizontal shaft vertical cutter rotary shears, attention is called to the fact that such shears



are almost universally made with but one speed and run very slowly. Curved lines can not be cut with them, and the cutters being large in diameter and straight-faced, it is extremely hard to guide the sheet on a straight line. If it is started the least bit out of line it is difficult to get back on the line and stay there, but with these electric shears

#### NEW HEAVY DUTY GRINDER

The Grinder illustrated shows a new line of heavy type machine being put on the market by the Ford-Smith Machine Company, of Hamilton, Ontario. The machine and countershaft are equipped with Hyatt roller bearings, and the loose pulley is fitted with S. K. F. ball bearings.



ROTARY SHEAR

the operator easily controls and guides the sheet, thus being able to cut rapidly and accurately.

It may be stated that each machine is provided with three different speeds, any one of which may be had instantly by the mere movement of a lever.

In cutting irregular work of very difficult pattern in large sheets merely throw the change speed lever over to low speed; gears are changed as quickly as gears are shifted in an automobile. In cutting work of medium character use the medium speed, and in straight work or easy curves use the high speed. In addition to the enormous advantage in cutting straight lines, it cuts serpentine and the most irregular zig-zagged shapes. It cuts openings of any shape without cutting it from side of sheet, and will cut an opening in one end of the sheet when the other end is too long to swing through the throat of the shear.

It will be seen that the sheet or plate to be cut does not have to be fed into the machine by a gang of men pushing and shoving as is necessary under old methods. Both cutters are driven, and the sheet is automatically drawn rapidly and continuously through the machine, cutting a square, true edge in one passage of the metal.—F.C.P.

rants the extra first cost. There is a further and continuous saving in abrasive or polishing wheels from the fact that no looseness develops in the bearings as in the case of regular bearings, causing vibration and rapid and untrue wear of the wheel.

Over and above these considerations is the accuracy and rapidity of grinding on a close-fitting, true-running abrasive wheel. Specifications of the machine shown include, wheels size 20 in. diameter and up to 4 in. face, spindle 2 3/16 in. in bearings, distance between abrasive wheels 37 in.

The Ford Smith Co., of Hamilton, Ont., are also manufacturing a line of ball bearing polishing machines for both large and small work.

#### THE ELECTRIC WORKSHOP REPAIR TRAIN

Everybody has heard about the wonderful system of light railways which the British constructed for military transport in Flanders, but only now has information been made available about the repair trains which travelled backwards and forwards on these lines for the purpose of effecting repairs. There were six of these trains, each consisting of six vehicles, carrying electric generating plant and all necessary machinery. The cars were lit and heated by electricity. Owing to the narrowness of the gauge—just under two feet—the sides of the vehicles containing the generators and machines were divided longitudinally and hinged at the bottom and the top so that the lower half might form a platform and the upper part a canopy when the train was "in action." During bad weather tarpaulins were fixed to the canopies and completely screened the men from wind and rain. Excellent service was rendered in many parts of the front by these workshop trains.



NEW HEAVY DUTY GRINDER







## Too Much Discussion

THE amount of talk that is going on regarding the bringing down of prices of basic materials is not doing any good as far as immediate business is concerned. For some weeks the United States authorities have been discussing the Bedford plan for moving to lower levels.

It is openly stated that lower levels for iron and steel will come. The result is so plain that it hardly needs to be stated. Buyers are staying out of the market until the promised reductions are made. If they are buying at all it is only for immediate needs and because they see a chance to pass on the higher priced material to the consumer.

It is a serious matter to delay and discuss too long about these matters. If price reductions are to be made they should be made definitely and for a period of some reasonable duration.

The market at present lacks assurance, and until that is given purchases will be made on a stingy basis.

Discussing this matter, one of the best informed steel men in the Dominion stated to CANADIAN MACHINERY:

"Confidence is all we need to start a buying movement; and such a condition was being slowly created until Redfield started his movement along the lines of lower prices. This immediately created a mental attitude lacking confidence, and it matters not what price they may now set, it will again take a period of time before confidence is sufficiently established to bring out any business. In other words—a new mental attitude must be created.

"Instead of preaching lower prices, we should be prosecuting a campaign of education along opposite lines. In other words—it is up to all public men, editors and politicians included, to preach the logic of present conditions, and try to establish in the minds of the buying public that a return to old-time conditions is out of the question; that present prices are the logical ones, as they are in keeping with the wages being paid and demanded, and along these lines we have not reached the limit by any means. Wages are not going to be reduced before being still further advanced. This will be brought about chiefly through a reduction in working hours.

"Prices at present on all commodities, while appearing high, are no higher in proportion than they formerly were. All things are relative, and after all is said and done, it is the buying power of the dollar that is the real basis of the argument. What difference does it make if my living expenses are \$10,000 and I earn \$10,000.00, as against a living expense of \$5,000.00 if I only earn \$5,000.00? In the former I at least have the satisfaction of spending a greater amount.

"The man to-day who is howling for low prices is a one-eyed individual, the other eye being blind to his own interests and, in consequence, is trying to bring about an impossible condition. In other words—he wants low prices to apply on that which he has to purchase, but he is not willing to accept, neither does he anticipate, a lower income. If he would only open his blind eye and give the matter a little serious consideration, he would realize that all things being relative if prices of commodities are extremely low, these low prices must be based on a low cost of production, and as wages represent a very large proportion of the cost of production, they must necessarily be reduced, which would be bound to affect his income. The low-price exponent—in my judgment—is a pest and, worse still, he is selfish, and this he reflects in the breadth of his vision, which does not extend any further than the brim of his hat. He can be found in high positions, often in the capacity of an official buyer, who howls from the housetops like a parrot, "Your prices are too high." He makes this statement without rule or reason, and his limited vision fails to carry him to the point of realizing that we who are trying to maintain the present price level are really holding an umbrella over his head and protecting millions' of dollars' worth of stocks that at present are lying in his and other warehouses all over the

world. In other words: if we were to comply with this type's wishes and establish a price on iron and steel products about where he, with his limited vision, would consider buying possible, it would automatically establish a price, which would determine the value of iron and steel stocks all over the world, and he, among others, would have to take their losses. It is amusing to know that when you point this out to some of them, they crawl into their shell."

## How Much Has Living Increased?

IT may be that no good purpose is served by references to the high cost of living. The joker has tried to explain some of it away by referring to the cost of high living. Well, allow for all that and you will find that there is still a big gap that has not been accounted for. There are individuals and families with very conservative tastes, and they find that they cannot stretch the family purse to meet the demands that are being made upon it.

The National Industrial Conference Board of United States has issued a most comprehensive resume on "War-time Changes in the Cost of Living." Conditions are much the same in the United States and Canada, and findings made there will have a very direct bearing here.

Taking the matter of food prices, the board states, "The National Industrial Conference estimated that between July, 1914, and June, 1918, the cost of food to the average wage-earner had gone up 62 per cent. Starting with an average of 100 per cent. for the year 1913, the highest increase is found by comparing November of 1913 with November of 1918. By months it looks like this:

	1913	1918
January .....	98	160
February .....	97	161
March .....	97	154
April .....	98	154
May .....	97	158
June .....	98	162
July .....	100	167
August .....	101	171
September .....	102	178
October .....	104	181
November .....	105	183
December .....	104	...

The matter of rents, etc., show large increases, but conditions are so different in this respect that it is not possible to draw comparisons that serve any good purpose.

In wearing apparel very careful budgets have been made up, and the results are well worth noting. Taking the man's budget, for his outfit in 1914 and 1918, the finding is that in the former year he had to spend \$58.70, while in 1918 he would have to pay \$111.70 for the same articles. Women's clothing is treated in the same way, and in 1914 the cost was \$58.15, while in 1918 the cost of these same articles had risen to \$109.40, or an increase of 88.1 per cent.

Under the heading of fuel, heat and light, a number of tables are presented, but the result of all can be gathered in the statement, "The increase in the cost of fuel, heat and light combined, between July, 1914, and November, 1918, is placed at 55 per cent."

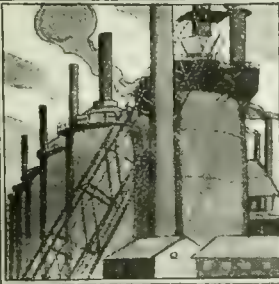
Summing up all the findings, the Board puts its seal of approval upon the following estimates of increases:

Food .....	80 %
Shelter .....	20 %
Clothing .....	93 %
Fuel, heat and light .....	55 %
Sundries .....	55 %

Bringing the above to an average, the figure found is 65.9%, which can be taken as accurate.

Our idea of ambition is a chap with no ear for music commencing to instruct himself on the use of that implement commonly referred to as the trombone.





## MARKET DEVELOPMENTS



### Price Reduction Talk Having Bad Effect

It is Causing Prospective Buyers to Stay Out of the Market—  
Something Definite in the Matter of Price Cuts is Expected to  
Come Out About the First of April

**T**HERE is a belief in certain sections of the steel and iron trade, and it seems to be fairly well founded, too, that the talk about price reductions coming is being carried on at too great length. It can have only one effect, that of holding back purchasing. There are firms to-day who would order one hundred tons of plate, for instance. They have the work to guarantee it. Instead of making it in one purchase, however, the policy is to let the mills have only twenty or so tons at a time, in the hope that at least a large portion of the order will get the benefit of whatever reductions may be made. It is also worth noting that as low as 2.85 per pound has been quoted at an American point for a fairly large sized order of plate. April 1 seems to be the date at which all agree something is liable to come out in regard to a new schedule of prices.

The scrap metal market continues dead. Dealers apparently have not the heart to come out and batter down the price lists to any lower level, although they could apparently do it. This market, it is expected, will improve when iron and steel come to levels where buying will commence. The two markets are very closely allied, as the scrap is needed as soon as the foundries begin taking on any very large tonnages of pig for actual use.

As soon as price matters are settled there should be a lot of business moving in Canada, as stocks are low and demands will be heavy.

Many of the machine tool dealers are now getting stocks that have been off the market for some time, owing to the factories that made them being engaged on munitions. Some of the builders also find that they have in their shops the "makings" of very heavy machines that were used primarily on certain operations in gun work. Very large gap lathes, for instance, are being offered direct from the mills at a considerable reduction on the usual price, and as one of these machines is apt to be an \$8,000 undertaking, a discount of ten or fifteen per cent. runs into some real money.

The bulk of the business that has been passing in machinery since the first of the year has been in rebuilt material. Some of the men in the business are showing considerable ingenuity in remaking war shop machines. In one place by a very simple contrivance a cutting-off machine, purely a war shop proposition, has been remade into a turret lathe.

Although there is nothing positive to go by, the rumor persists that higher prices will be asked for drills, taps, reamers, etc.

### SOME ADJUSTMENTS HAVE ALREADY BEEN ALLOWED TO MONTREAL SHOPS

Special to CANADIAN MACHINERY

**M**ONTREAL, Que., March 20.—Re-adjustment is gradually taking place among the industries in this district, and some of the plants that were engaged in the making of munitions for the American Government have had a settlement of account, while others are nearing the point where final adjustment will be made. Much of the machinery that has seen war service has been disposed of, considerable going to buyers in the States, while others have been dismantled and utilized as scrap. Plants having a foundry in connection with the business have used much of this scrap for the making of new castings. A large quantity of equipment, however, is still piled in parts of many of the old shell shops. General machine-tool business is not active but a steady trade is being carried on and dealers appear satisfied with the present demand. The metal

situation shows little change and business is steady but light in character. Steel business is rapidly returning to a competitive basis but poor demand is still a factor. Old material is particularly quiet and weakness is a feature.

#### Marking Time in Steel

Interest in steel circles is still centred in the probable outcome of the conference to be held this week between the producers and the American Government representatives, when it is expected that action will be taken, through which the basis of steel operations will be adjusted to meet the desires and requirements of general business. The feeling appears to be that some concessions will be made whereby reduced prices will be established for some of the leading lines, but nothing definite will be announced until after the meeting.

Present production costs, as stated by a dealer here, will be an important factor in adjustment to lower levels, and if reductions are the outcome, steps will undoubtedly be taken to adjust wages to meet the new conditions. Dealers here are marking time, intimating that revisions will likely follow any price changes in the States. Business here is steady, immediate requirements absorbing the bulk of the demand.

#### Further Decline in Metal

Trading in metals is still of a very quiet character, little activity being reported. Dealers intimate that copper is showing slight improvement in the States but believe that it is only of a transient kind and that weakness will follow. The poor demand here has resulted in a lower scale of prices, and the quotation of 19 and 20 cents shows a decline of 1 cent per pound. There has been little extra demand for tin, but trading is fairly steady but comparatively light; price is maintained at 58 cents per pound. No improvement is shown in spelter and consumers apparently are



not interested; this week's quotation of 9 cents represents a decline of  $\frac{1}{4}$  cent per pound. Conservative buying is reported in lead, with prices firm at  $7\frac{1}{2}$  cents per pound. Antimony is quiet on poor demand and prices are slightly shaded, the quotation this week being 8 cents per pound. Aluminum is quiet and unchanged.

### Better Inquiry Developing

It cannot be said that operations in the machine tool trade have shown any greater activity, nor can it be said that dullness prevails. Demand is not marked, but business is of a steady character, considering present unsettled conditions. Some dealers report a better inquiry and intimate that new departures are contemplated by some firms, but what lines are under consideration are being kept comparatively secret. It has been stated that one large firm here is going into the manufacture of farm tractors, but they are still negotiating with the U. S. Government respecting settlement of munitions contracts. Several inquiries are announced regarding certain tools for this particular firm. Disposal of used equipment is still a factor here, and there are few firms in the district but what have tools for sale, but no extraordinary effort is being made to force these on the market. Sales of second-hand machine tools, suitable for general purpose work are still being made to small buyers for use in country repair shops. Supply demand is well maintained and is a substantial factor in stabilizing a period otherwise remarkably quiet.

### Scrap Trading Almost Stopped

"The market has been very quiet during the past week; in fact there has been practically nothing doing whatever. The prices you now quote might be shaded a little but they may as well stand as they are, as we are not anxious to take any more material into the yard unless we are assured of an immediate sales for the same, and with the demand almost negative, this is very improbable." This statement from a dealer here sets forth the stagnant condition of the situation, and few will advance an opinion as to the early future prospects.

"Industrial developments are taking place slowly and demand for old materials is contingent on business expansion," remarked one dealer; "we are in hopes that prices will remain firm, but the tendency is for further weakness." Prices here are not changed and could be considered as figures the dealers are willing to pay for material, delivered.

## FEEDING ORDERS OUT IN SMALL LOTS NOW

Because it Seems Likely That Lower  
Prices are Coming Around

April 1

TORONTO.—Dealers in machinery are of the opinion that they are approaching the state where the sale of new machine tools will commence. For some weeks past there has been, in the metal working industries, a fair demand for equipment, but it has been drawn

## POINTS IN WEEK'S MARKETING NOTES

American steel mills are trying to keep their rollers going at a high rate to keep production costs down. Meanwhile some of the sales managers are beginning to face a real problem in what to do with the stuff.

The business of price-deflation is going to be gone ahead with as soon as the details can be worked out. The last meeting of the steel interests was interfered with by the absence, through illness, of Judge Gary, of the Corporation.

The belief becomes more general that were a good-sized order for pig iron to come into the market in the big centres that the price would be reduced to meet the situation. Some No. 2 foundry iron has been sold at \$28, which is \$3 under the recognized level of the market at present.

Opinion seems to be growing that there is going to be no glutting of the labor market for a long time to come. Many foreigners are already going back to Europe, and there was a large exodus of them before and during the war. Added to this there is a decided tendency on the part of the United States and Canada to restrict immigration.

Dealers in Toronto hear that a price as low as 2.85 has been given for a good-sized tonnage of steel plate and there is a decided tendency now to order very close to the actual needs until something definite develops.

Machine tool builders are in a position now to give a much better delivery than formerly, and they are coming into the market again with lines that have been off since the manufacture of munitions was started.

largely from the used machinery classes, and there have been some good purchases made. This class of trade has been good.

The scrap metal market is just in the same stagnant position. There are no sales worth recording. Rumors are still going around to the effect that higher prices are certain on machine supplies, especially for such material as high-speed taps, reamers, cutters, etc.

### Holding Back Now

Customers are not buying any more material than they have to from the steel people. They are feeding out their wants in very small lots and they are not going to be budged from this attitude until some very definite announcement is forthcoming regarding the future prices. It is almost certain that no announcement will be made before the first

of April. In fact mills that handle a lot of Canadian business have given their agents here every assurance that they will not make any move until the first of April. That may apply in a broad sense, but it is known to a good many in the business that shading in prices has been going on for some time, especially if there is anything that looks like a fair-sized tonnage on the horizon. Advices from some of the American markets bear out this same thing, one of the items being that this week a price of 2.85 has been quoted on plate, which is a departure in itself of \$3 per ton from the recognized figures of the market.

Some of the mills know very well, too, that warehouses and large buyers are not sending on their usual stock orders. They are holding them back. Here is how it works out in the case of one of the large boiler shops that is busy now. They have an order in for about one hundred tons of plate and depend on the warehouses to get the best possible treatment for them. In order to keep the shipments coming that they must have, an allotment of 25 tons has been placed at 3c, while the rest of the order is being held up until the first lot is worked out. In this way it is expected that they will be able to get the advantage of a rate under 3c on at least half of this business. Mills at United States points are anxious to get business now. They want to keep going in order that their overhead charges shall not run away with them. To do this they are willing to take on Canadian business now and give the buyers the advantage of any reductions that are made on or around April 1. Warehouses look for a lot of business soon. One of the dealers stated the CANADIAN MACHINERY: "As soon as things settle down a little more there should be a lot of good business moving. The material is wanted and the stocks are very low. We are looking for better times in the weeks to come."

### The Machine Tool Trade

Makers of machine tools are clearing out their stock after the rush of war work is over. They find in many cases that they have material in hand for turning out machines on quick delivery, naming a shipment date in many cases of not over two weeks from the time of order. For instance, one well-known firm have the "makings" on hand for ten big lathes, 42 in. x 34 in. There is of course a limited demand in this country for such machines, and the chances are that they were undertaken in the first place for gun work. Other machine tool builders were forced to drop certain of their lines during the period of the war. Circulars coming to Toronto dealers this week announce that bevel gear-turning machines which were popular with one firm, are again to be had. They are particularly applicable for the manufacture of differentials for auto use.

There are signs of an active campaign being undertaken on the part of several large firms making machine tools looking to more rapid selling of their product. The firms are working for the



most part on stock, and actual business placed is rather light.

The supply departments have no intimation of change in prices, but it is persistently rumored that higher figures are going to be asked for high-speed lines of reamers, drills, cutters, etc. The claim is made that right now these are being sold in Canada for prices below those prevailing in the United States.

#### The Scrap Metal Market

Dealers have no changes to suggest in the price lists this week. Apparently they have not the heart to get out and slug the values again or attempt to beat

them to any lower levels. On the other hand there is nothing to indicate that lower levels will not be reached. The one thing that can help the situation is a period of buying, and that is not likely to take place until manufacturers come heavily into the market for pig iron as well as scrap.

The American market at the present moment is not of much use as an outlet for material that gets piled up in the yards on this side of the line. In fact it is a long time since there has been any success attending the efforts to trade across the line.

## SALES MANAGERS WONDER WHERE THEY CAN DISPOSE OF THE OUTPUT

Special to CANADIAN MACHINERY

PITTSBURGH, Pa., March 20.—As noted in last report the steel industry in February operated at the surprisingly high rate of about 84 per cent. of capacity. Operations have of course been tapering off, but they may be estimated this week at fully 75 per cent. of capacity. Some of the plants are aiming to run full, so as to keep down overhead and operating conditions prove so favorable that tonnages are large. This is advantageous from the cost standpoint but it is somewhat embarrassing, particularly to sales managers. The only mills that can do this, of course, are those that are in position to stock a portion of their output, but some mills that have storage facilities do not use them.

#### Steel Corporation Obligations

It is strongly intimated in well posted quarters that the Steel Corporation, whatever may be the case of the independents, is fairly well fortified to run at a moderate rate for several months to come, on its old orders. It is asserted that all the cancellations necessary by reason of the war ending have now been made and that the monthly report of "unfilled tonnage" will no longer reflect any such cancellations. If all is true the corporation is in distinctly stronger position than the independents. Its last report showed that at the end of February there was 6,010,787 tons of unfilled obligations on books. There had been a decrease in three months from the 8,124,663 tons reported at the end of November, or a trifle over 2,000,000 tons. One would have supposed, last November, that the ending of the war would cause the cancellation of about one-quarter of that tonnage, but such a tonnage would represent approximately the total decrease that has since occurred. If one accept such a view, therefore, he has to admit that the new bookings in the three months were about equal to the shipments, which may be estimated at 3,500,000 tons. That any such high rate of booking actually occurred, however, is very doubtful, considering how very dull the market was reported to be during much, if not all, of the period.

#### Meeting Postponed

The trade has expressed much regret

at the postponement of the meeting that was to have been held March 13 between the Industrial Board and the general committee of the iron and steel industry. Hopes had been entertained that at this meeting a basis for price deflation would be reached so that the iron and steel trade, buyers and sellers, would have an opportunity to go ahead. The postponement was due to Judge Gary's illness, his presence being regarded as absolutely essential on account of his recognized fairness and his ability to detach himself from personal and immediate trade interests. The Industrial Board, however, has evinced no impatience at the delay, and indeed has made the statement that it expects to get through with its price deflation work in 60 to 90 days, this including lumber, brick and various building materials, besides iron and steel.

#### Markets Dull

The pig iron, unfinished steel and finished steel markets have been particularly dull in the past week and indeed in the past fortnight. It seems that while all buyers had previously been pursuing a hand to mouth policy in buying, they were able to display fresh powers of waiting when it became apparent that prices would probably be reduced, and materially reduced, by April 1 if not sooner.

In the case of pig iron there is not enough inquiry to test the market, as a rule. In many quarters it is believed that all that is needed to bring down the price of a given grade of pig iron in any district is for a fairly good sized order to be offered to producers, whereupon one or another would cut the recognized price. Such inquiry, however, is lacking, save for occasional exceptions. As noted in last report, some valley furnaces had quoted \$28 or less at furnace for No. 2 foundry iron, or \$3 a ton under the previously recognized price, and making foundry iron quotable at \$28, valley. Meanwhile, however, nothing has occurred in Bessemer or basic in the local market, and these grades are still quotable nominally at \$32.20 and \$30 respectively, at furnace. Reports from Chicago, however, are to the effect

that a sale of a good sized tonnage of basic iron was made at \$25, Chicago furnace, or \$5 a ton under the previously recognized price. The story is that the buyer is a wire interest, with steel mill but no blast furnaces, so that it was able to offer an order of tonnage importance.

In finished steel products there is not enough business going to test prices, but it is commonly assumed that the mills, save in exceptional cases, would not cut prices in order to obtain business, as such a procedure might interfere with the price deflation program that is to be carried out in connection with the Industrial Board at Washington. Naturally it is greatly desired that when prices are reduced the new reduced prices shall hold well. There are of course some exceptions, it being reported, probably correctly, that plates have sold at \$2.85, Pittsburgh, that being \$3 a net ton under the recognized quotation.

#### Improving Sentiment

While steel producers are usually quite blue when they are not effecting large sales and the mills are not falling behind in deliveries, there is a greater note of hopefulness among producers, and as to buyers they are not pessimistic by any means. Some are now found who assert positively that they are prepared to place good sized orders if there are reasonable reductions in prices. It is now felt in many quarters that the bearish sentiment has run altogether too far, that the country has been disposed to cry out before it was really hurt, and that with a moderate amount of readjustment in prices business can be resumed on a good scale. One impressive fact is that the country has been taking so much steel since the armistice was signed, when apparently there was little consumptive demand. If so much steel is required when there is little activity there ought to be much more needed when business conditions are really good.

There is much less talk than formerly about the necessity for wage reductions and indeed it is far from probable that there will be any general wage reductions in the next few months. Indeed, the idea in some quarters is that by reason of four years' cessation of immigration already, with no prospect of its being resumed and rather with prospects that possibly a few hundred thousand workmen will leave the country to join the new republics being set up in the interest of their races in Europe, labor will be able to command very high rates right along. It is admitted with somewhat more frankness than formerly that manufacturers' war time profits will have to be greatly reduced.

As to labor, furthermore, there has been a great improvement in that labor is much more efficient. Better work is being secured for a day's pay, and various frills, premiums, etc., are being cut off here and there, so that while general wage rates have not been reduced, labor costs have shrunk very materially at many plants.



## AMERICAN FIRMS ARE SHADING PRICES

And There is a Gradual Improvement in the Machine Tool Market Now

Special to CANADIAN MACHINERY

NEW YORK, March 20.—There is a gradual but steady improvement in machine tool business. In fact, the amount of business being placed in some lines is quite surprising, even to the machine tool builders, who had not looked for any great amount of activity by this time. Some of the leading plants have a great deal of work on hand. A company making milling machines, for which there has been an exceptionally good demand, is working a night shift. Builders of gear cutters and gear shapers have also had a good business.

Prices on machine tools, traveling cranes, locomotive cranes and other machinery are being reduced, some lines showing more of a reduction than others. Builders of planing machines have announced a formal cut of about 20 per cent. Concessions of various kinds are being offered by tool builders to get business even where formal quotations have not been changed. On traveling cranes there have been reductions from a war basis of from 25 to 50 %, and on locomotive cranes the reductions vary from 20 to 25 per cent.

### Doing Buying Now

New business is coming along in fair volume in the New York market, though general conditions are and have been for some weeks better in Chicago, Detroit and Cleveland than in the East. A Swiss concern has issued a large list of equipment, 100 or more tools, for a plant to be built in the East for making knitting machinery. The Crucible Steel Co. of America has bought a list of machine-shop equipment for machining forgings at its Harrison, N.J., works. The E. W. Bliss Co., Brooklyn; the New Jersey Zinc Co., New York, and the F. L. Schmidt Co., New York, are in the market for some new equipment.

The Navy Department is continuing its policy of expansion and is calling for bids on about 50 tools for the Norfolk Navy Yard. Bids will be opened in Washington, March 25.

### War Tools Coming Out

The machine-tool trade has been waiting with interest and some apprehension the release upon the market of large quantities of new and second-hand tools from war plants. In the middle West the equipment of several plants has been absorbed by dealers and put on the market without a great deal of disturbance to general business in new tools. The first really large list in the East has been issued by the International Arms & Fuse Corporation, Bloomfield, N.J., which was engaged in shell and fuse work during the war. This list consists of hundreds of tools, many of them practically as good as new. They are being offered to dealers and others

Other lists of tools are being offered by the New York Air Brake Co., Watertown, N.Y., and the H. H. Franklin Mfg. Co., Syracuse, N.Y. The latter concern had just concluded a large contract for airplane engine crankshafts when the war ended and had a great deal of new equipment on hand, some of which has never been uncased. The Franklin Company bought this entire equipment from the War Department at 60 per cent. of its invoice price, and is now reselling such tools as it does not require for its own plant.

The New York Air Brake Co. has an-

## LOWER IRON PRICES WILL HELP THE SCRAP METAL SITUATION IN U.S.

ALTHOUGH a great deal of difference has not resulted, there is a feeling in many points in the United States that the scrap metal situation is very much improved. In several of the leading lines there is a shortage at present and it requires only a very little demand to start the prices on the upgrade. The Canadian conditions are no better than reported last week. The following reports show how they are standing at present:

CHICAGO.—The feeling is noted in the market here, and several dealers who have had to apply sales on orders that were booked for quick delivery find that they must pay the advance price to obtain the necessary material. Right now No. 1 cast scrap is scarce and is selling much higher than heavy melting steel, which is a most unusual situation.

NEW YORK.—Prices here are holding steady and several dealers report that sellers are much less inclined to accept offers for their holdings than for many weeks past. A big sale of cast steel shells was put through a few days ago, the deal amounting in all to 1,300 tons of the 12 inch kind.

PITTSBURGH.—A very small amount of cast scrap has been offered and probably on account of this the price has started to go up, particularly as there is a better demand for it just now.

PHILADELPHIA.—The purchases of iron and steel scrap continue to be very small. There seems to be a feeling around the market here that the prices have gone down as far as possible but of course there is nothing to indicate this to any degree of certainty.

CLEVELAND.—A rather unique way of looking at the prices of iron and steel has been advanced by some of the dealers in the scrap market here. They hold that as soon as reductions are made in the price of pig iron that there will be better times ahead for the scrap metal markets. The reason they advance for this is that price reduction will stimulate buying of iron and of course that will mean more scrap needed to use in mixing purposes. Cleveland's scrap prices have not changed during the week and many of the deal-

ers state that it is not possible for them to go any lower.

BUFFALO.—There is a decided improvement in the tone of the scrap metal market here this week, and the view is taken that as soon as there is a reduction in the price of pig iron that matters will be much better. In fact the belief is common here that if buying is resumed with pig iron selling around \$26, the price for heavy melting steel should reach from \$19 to \$20 per ton.

ST. LOUIS.—One thing that is holding up the trade here at present is that the Steel Mills are not in the market as purchasers. In fact many of them are seeking to cancel the contracts they have already made. Some of these mills have very large accumulations of material in their yards at the present time, and they are not desirous of stocking up with material that is liable to go to a lower value.

## CANADA LOSES BY NOT HAVING SHIPS

Ships Transferred During the War Should be Returned to This Country

London.—It is not probably appreciated in Canada that just about one-third of the fifty million dollars credit established for Canadian supplies to France and Roumania will go to British shipping interests. In transferring goods from Canada to these countries, pointed out E. M. Macdonald, former member for Pictou, in an interview, this great proportion of the profits will be lost to Canada through our not having ships. With Mark Workman, president of the Dominion Steel Company, Mr. Macdonald is in England trying to secure five of the eight ships belonging to that company which were taken by the British Ministry of Shipping during the war. Three have already been returned.

### U. S. Gets Our Trade

Before the war the Nova Scotia coal mines had the whole of the St. Lawrence market shipping, amounting to two and a half million tons a year. When the ships were given over the United States mines supplied this market and are still supplying it.



# SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

## PIG IRON

Grey forge, Pittsburgh .....	\$31 40
Lake Superior, charcoal, Chicago.	38 85
Standard low phos., Philadelphia .....	
Bessemer, Pittsburgh .....	33 60
Basic, Valley furnace .....	30 00
Toronto price:—	
Silicon .2.25% to 2.75%	\$37.00 to \$40.00

## IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto .....	\$ 4 75
Steel bars, base, Toronto .....	5 00
Steel bars, 2 in. to 4 in. base.....	6 00
Steel bars, 4 in. and larger base..	7 00
Iron bars, base, Montreal .....	4 55
Steel bars, base, Montreal .....	5 05
Reinforcing bars, base .....	4 50
Steel hoops .....	6 00
Norway iron .....	11 00
Fire steel .....	5 50
Spring steel .....	8 00
Brand steel, No. 10 gauge, base	4 75
Chequered floor plate, 3-16 in....	9 25
Chequered floor plate, ¼ in. ....	9 00
Staybolt iron .....	9 00
Bessemer rails, heavy, at mill....	
Steel bars, Pittsburgh .....	2 70
Tank plates, Pittsburgh .....	3 00
Structural shapes, Pittsburgh .....	2 80
Steel hoops, Pittsburgh .....	3 30
F.O.B., Toronto Warehouse	
Steel bars .....	4 75
Small shapes .....	5 00
F.O.B. Chicago Warehouse	
Steel bars .....	4 10
Structural shapes .....	4 20
Plates .....	4 45

## FREIGHT RATES

	Per 100 lbs.	C.L.	L.C.L.
Pittsburgh to Following Points			
Montreal .....	29	39½	
St. John, N.B. ....	47½	63	
Halifax .....	49	64½	
Toronto .....	23½	27½	
Guelph .....	23½	27½	
London .....	23½	27½	
Windsor .....	23½	27½	
Winnipeg .....	81	106½	

## METALS

Lake copper .....	\$20 00	\$ 22 00
Electro copper .....	19 00	22 00
Castings, copper .....	19 00	20 00
Tin .....	58 00	62 00
Spelter .....	9 00	8 50
Lead .....	7 50	6 50
Antimony .....	8 00	8 50
Aluminum .....	40 00	40 00

Prices per 100 lbs.

## PLATES

	Montreal	Toronto
Plates, ¼ up .....	\$ 5 50	\$ 5 50
Plates, 3-16 in. ....	5 75	5 75

Price List No. 38

## Standard Buttweld

	Per 100 feet	
1/8 in. ....	\$ 6 00	\$ 8 00
1/4 in. ....	4 68	6 81
3/8 in. ....	4 68	6 81
1/2 in. ....	6 21	7 78
3/4 in. ....	7 82	9 95
1 in. ....	11 56	14 71
1 1/4 in. ....	15 64	19 90
1 1/2 in. ....	18 70	23 76
2 in. ....	25 16	32 01
2 1/2 in. ....	40 37	51 19
3 in. ....	52 79	66 94

3½ in. ....	67 16	84 18
4 in. ....	79 57	99 74
Standard Lapweld		
2 in. ....	38 81	35 34
2½ in. ....	42 12	52 36
3 in. ....	55 08	68 47
3½ in. ....	69 00	86 94
4 in. ....	81 75	103 00
4½ in. ....	93	1 18
5 in. ....	1 08	1 37
6 in. ....	1 40	1 78
7 in. ....	1 83	2 32
8L in. ....	1 93	2 44
8 in. ....	2 22	2 81
9 in. ....	2 66	3 36
10L in. ....	2 46	3 12
10 in. ....	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces.

## WROUGHT NIPPLES

4" and under, 45%.	
4½" and larger, 40%.	
4" and under, running thread, 25%.	
Standard couplings, 4" and under, 35%.	
4½" and larger, 15%.	

## OLD MATERIAL

Dealers' Buying Prices.

	Per 100 Pounds	Montreal	Toronto
Copper, light .....	\$10 50	\$10 00	
Copper, crucible .....	13 00	12 75	
Copper, heavy .....	13 00	15 00	
Copper wire .....	13 00	15 00	
No. 1 machine composition .....	10 00	12 00	
New brass cuttings ....	8 00	9 00	
Red brass turnings ....	8 00	8 50	
Yellow brass turnings..	6 00	6 00	
Light brass .....	5 00	5 00	
Medium brass .....	8 00	6 00	
Scrap zinc .....	4 00	5 00	
Heavy lead .....	3-4	4 00	
Tea lead .....	2-3	3 00	
Aluminum .....	15 00	12 00	

	Per Ton	
Heavy melting steel....	10 00	9 00
Shell turnings .....	6 00	6 00
Boiler plate .....	12 00	8 00
Axles (wrought iron) ..	20 00	15 00
Rails .....	15 00	11 00
Malleable scrap .....	15 00	12 00
No. 1 machine cast iron	18 00	14 00
Pipe wrought .....	9 00	5 00
Car wheels .....	20-22	18 00
Steel axles .....	22 00	20 00
Mach. shop turnings....	6 00	5 00
Stove plate .....	14 00	10 00
Cast boring .....	8 00	8 00

## BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ¾" and less ....	10
Carriage bolts, 7-16 and up .....	net
Coach and lag screws .....	25
Stove bolts .....	55
Plate washers .....	List plus 20
Elevator bolts .....	5
Machine bolts, 7-16 and over ....	net
Machine bolts, ¾" and less .....	10
Blank bolts .....	net
Bolt ends .....	net
Machine screws, fl. and rd. hd., steel .....	27½
Machine screws, o. and fil. hd., steel	10

Machine screws, fl. and rd. hd., brass .....	add 20
Machine screws, o. and fil. hd. brass .....	add 25
Nuts, square blank .....	add \$1 50
Nuts, square, tapped .....	add 1 75
Nuts, hex., blank .....	add 1 75
Nuts, hex., tapped .....	add 2 00
Copper rivets and burrs, list plus	30
Burrs only, list plus .....	50
Iron rivets and burrs .....	25
Boiler rivets, base ¾" and larger	\$8 50
Structural rivets, as above.....	8 40
Wood screws, flat, bright .....	72½
Wood screws, O. & R., bright....	67½
Wood screws, flat, brass .....	37½
Wood screws, O. & R., brass .....	32½
Wood screws, flat, bronze .....	27½
Wood screws, O. & R., bronze .....	25

## MILLED PRODUCTS

	Per Cent
Set screws .....	25
Sq. & Hex. Head Cap Screws....	20
Rd. & Fil. Head Cap Screws ....	net
Flat But. Hd. Cap Screws.....	plus net
Fin. & Semi-fin. nuts up to 1 in....	25
Fin. & Semi-fin. nuts, over 1 in., up to 1½ in. ....	20
Fin. and Semi-fin. nuts over 1½ in., up to 2 in. ....	plus 10
Studs .....	net
Taper pins .....	40
Coupling bolts, plus .....	10
Planer head bolts, without fillet, list plus .....	10
Planer head bolts, with fillet, list plus 10 and .....	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers .....	net
Hollow set screws .....	list plus 20
Collar screws .....	list plus 30, 10
Thumb screws .....	20
Thumb nuts .....	65
Patch bolts .....	add 40, 10
Cold pressed nuts to 1½ in....	add \$4 50
Cold pressed nuts over 1½ in....	add 7 00

## BILLETS

	Per gross ton
Bessemer billets .....	\$43 50
Open-hearth Billets .....	43 50
O.H. sheet bars .....	47 00
Forging billets .....	56 00
Wire rods .....	57 00

Government prices.

F.O.B. Pittsburgh.

## NAILS AND SPIKES

Wire nails .....	\$5 50	\$5 30
Cut nails .....	5 85	5 65
Miscellaneous wire nails .....		60%
Spikes, ¾ in. and larger .....		\$7 50
Spikes, ¼ and 5-16 in. ....		8 00

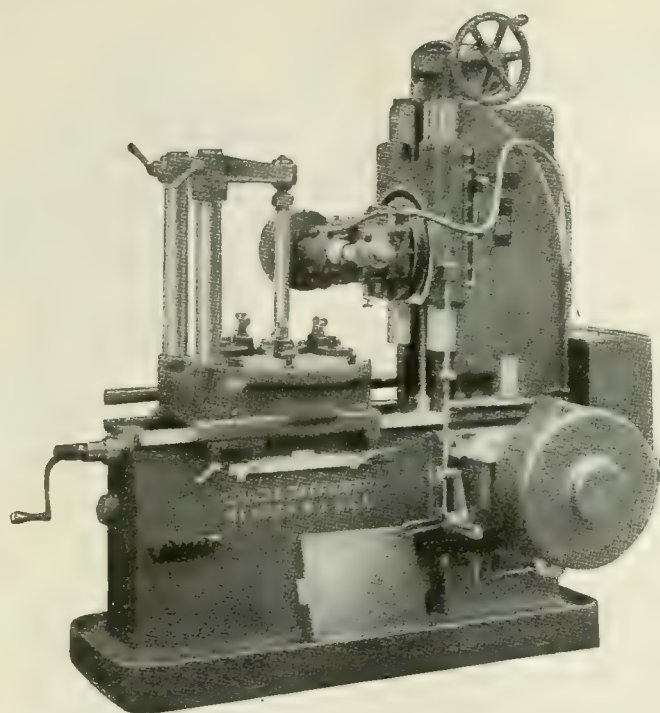
## ROPE AND PACKINGS

Drilling cables, Manila .....	0 39
Plumbers' oakum, per lb. ....	0 10
Packing, square braided .....	0 38
Packing, No. 1 Italian .....	0 44
Packing, No. 2 Italian .....	0 36
Pure Manila rope .....	0 37
British Manila rope .....	0 31
New Zealand hemp .....	0 31
Transmission rope, Manila .....	0 43
Cotton rope, ¼-lb. and up.....	0 74

## POLISHED DRILL ROD

Discount off list, Montreal and Toronto .....	net
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Gears up to 120" dia. Also

Multiple Spindle, Continuous Operation Automatic Roughing Machines for large production.

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up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

*Prices on Application—Prompt Deliveries*

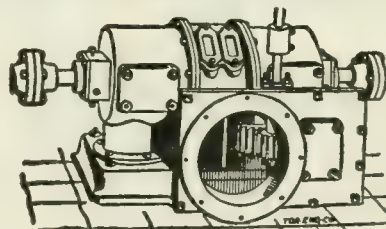
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**J. C. WILSON & CO.**  
BELLEVILLE, ONTARIO



## MISCELLANEOUS

Solder, strictly .....	0 34
Solder, guaranteed .....	0 39
Babbitt metals .....	18 to 70
Soldering coppers, lb. ....	0 58
Lead wool, per lb. ....	0 14
Putty, 100-lb. drums .....	6 75
White lead, pure, cwt. ....	17 80
Red dry lead, 100-lb. kegs, per cwt. ....	15 50
Glue, English .....	0 35
Tarred slater's paper, roll ...	1 30
Gasoline, per gal., bulk .....	0 33
Benzine, per gal., bulk .....	0 32
Pure turpentine, single bbls., gal. ....	1 10
Linseed oil, raw, single bbls. ...	1 70
Linseed oil, boiled, single bbls. ...	1 73
Plaster of Paris, per bbl. ....	4 50
Sandpaper, B. & A. ....	List plus 43
Emery cloth .....	list plus 37½
Sal Soda .....	0 03½
Sulphur, rolls .....	0 05
Sulphur, commercial .....	0 04½
Rosin "D," per lb. ....	0 07
Rosin "G," per lb. ....	0 08
Borax crystal and granular .....	0 14
Wood alcohol, per gallon .....	2 00
Whiting, plain, per 100 lbs. ....	2 50

## CARBON DRILLS AND REAMERS

	Per Cent
S.S. drills, wire sizes up to 52 ...	35
S.S. drills, wire sizes, No. 53 to 80	40
Standard drills to 1½ in. ....	40
Standard drills, over 1½ in. ....	40
3-fluted drills, plus .....	10
Jobbers' and letter sizes .....	40
Bit stock .....	40
Ratchet drills .....	15
S.S. drills for wood .....	40
Wood boring brace drills .....	25
Electricians' bits .....	30
Sockets .....	40
Sleeves .....	40
Taper pin reamers .....	net
Drills and countersinks .....	list plus 40
Bridge reamers .....	50
Centre reamers .....	10
Chucking reamers .....	net
Hand reamers .....	10
High speed drills, list plus .....	75
High speed cutters, list plus .....	40

## COLD ROLLED SHAFTING

At mill .....	list plus 40%
At warehouse .....	list plus 60%
Discounts off new list. Warehouse price at Montreal and Toronto	

## IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¼c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

## SHEETS

	Montreal	Toronto
Sheets, black, No. 28 ..	\$ 7 00	\$ 6 50
Sheets, black, No. 10 ..	6 50	6 00
Canada plates, dull, 52 sheets .....	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¼ oz. galvanized .....		
Queen's Head, 28 B.W.G. ....		
Fleur-de-Lis, 28 B.W.G. ....		
Gorbal's Best, No. 28 ..		
Colborne Crown, No. 28 ..		
Premier, No. 28 U.S. ....	8 20	
Premier, 10¼ oz. ....	8 50	
Zinc sheets .....	20 00	20 00

## PROOF COIL CHAIN

¼ in., \$14.35; 5-16 in., \$13.85; ¾ in., \$13.50; 7-16 in., \$12.90; ½ in., \$13.20;

\$13.00; ¾ in., \$12.90; 1 inch, \$12.65; Extra for B.B. Chain, \$1.20; Extra for B.B.B. Chain, \$1.80.

## ELECTRIC WELD COIL CHAIN B.B.

¾ in., \$13.00; 3-16 in., \$12.50; ¼ in., \$11.75; 5-16 in., \$11.40; ½ in., \$11.00; 7-16 in., \$10.60; ½ in., \$10.40; ¾ in., \$10.00; ¾ in., \$9.90.

Prices per 100 lbs.

## FILES AND RASPS.

	Per cent.
Globe .....	50
Vulcan .....	50
P.H. and Imperial .....	50
Nicholson .....	32½
Black Diamond .....	32½
J. Barton Smith, Eagle .....	50
McClelland, Globe .....	50
Delta Files .....	20
Disston .....	40
Whitman & Barnes .....	50

## BOILER TUBES.

Size	Seamless	Lapwelded
1 in. ....	\$28 00	\$.....
1¼ in. ....	32 00	.....
1½ in. ....	35 00	28 00
1¾ in. ....	35 00	28 00
2 in. ....	40 00	28 00
2¼ in. ....	43 00	30 00
2½ in. ....	45 00	35 00
3 in. ....	52 00	40 00
3¼ in. ....	.....	47 00
3½ in. ....	62 00	48 00
4 in. ....	70 00	60 00

Prices per 100 ft., Montreal and Toronto les 10.

## OILS AND COMPOUNDS.

Castor oil, per lb. ....	
Royalite, per gal., bulk .....	19½
Palacine .....	22½
Machine oil, per gal. ....	27½
Black oil, per gal. ....	16
Cylinder oil, Capital .....	52
Cylinder oil, Acme .....	39½
Standard cutting compound, per lb. 0	06
Lard oil, per gal. ....	\$2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic .....	37½
Imperial quenching oil .....	39½
Petroleum fuel oil, bbls. net .....	10¼

## BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double ..	30%
Standard .....	30, 10%
Cut leather lacing, No. 1 .....	2 20
Leather in sides .....	1 75

## TAPES.

Chesterman Metallic, 50 ft. ....	\$2 00
Lufkin Metallic, 603, 50 ft. ....	2 00
Admiral Steel Tape, 50 ft. ....	2 75
Admiral Steel Tape, 100 ft. ....	4 45
Major Jun. Steel Tape, 50 ft. ....	3 50
Rival Steel Tape, 50 ft. ....	2 75
Rival Steel Tape, 100 ft. ....	4 45
Reliable Jun. Steel Tape, 50 ft. ....	3 50

## PLATING SUPPLIES.

Polishing wheels, felt .....	3 25
Polishing wheels, bull-neck ..	2 00
Emery in kegs, American .....	07
Pumice, ground .....	3½ to 05
Emery glue .....	28 to 30
Tripoli composition .....	06 to 09
Crocus composition .....	08 to 10
Emery composition .....	08 to 09
Rouge, silver .....	35 to 50
Rouge, powder .....	30 to 45

Prices Per Lb.

## ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive .....	.08½
Grits, 80 and finer .....	.06

## BRASS

Brass rods, base ½ in. to 1 in. rod	0 38
Brass sheets, 24 gauge and heavier, base .....	0 43

Brass tubing, seamless .....	0 46
Copper tubing, seamless .....	0 48

## WASTE

**WASTE**

White	Cts. per lb.
XXX Extra...19½	Atlas .....17
Peerless .....19	X Empire ....15½
Grand .....18	Ideal .....16
Superior .....18	X press .....14
X L C R ....17	

## Colored.

Lion .....	15	Popular .....	12
Standard .....	13½	Keen .....	10½
No. 1 .....	13½		

## Wool Packing.

Arrow .....	25	Anvil .....	15
Axle .....	20	Anchor .....	11

## Washed Wipers.

Select White. 11	Dark colored. 09
Mixed colored 10	

This list subject to trade discount for quantity.

## RUBBER BELTING.

Standard ... 10%	Best grades .. 15%
------------------	--------------------

## ANODES.

Nickel .....	.58 to .65
Copper .....	.38 to .45
Tin .....	.70 to .70
Zinc .....	.18 to .18

Prices Per Lb.

## COPPER PRODUCTS.

	Montreal	Toronto
Bars, ½ to 2 in. ....	42 50	43 00
Copper wire, list plus 10 ..		
Plain sheets, 14 oz., 14x60 in. ....	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz. ....	48 00	48 00
Copper sheet, planished, 16 oz. base .....	46 00	45 00
Braziers' in sheets, 6x4 base .....	45 00	44 00

## LEAD SHEETS.

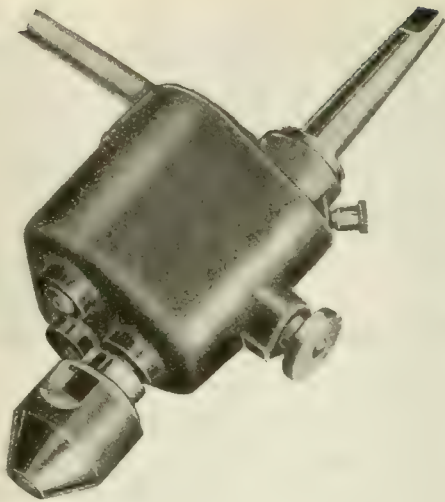
	Montreal	Toronto
Sheets, 3 lbs. sq. ft. ....	\$10 25	\$10 25
Sheets, 3½ lbs. sq. ft. ....	10 00	10 00
Sheets, 4 to 6 lbs. sq. ft. ....	9 75	9 75
Cut sheets, ½c per lb. extra.		
Cut sheets to size, 1c per lb. extra.		

## PLATING CHEMICALS.

Acid, boracic .....	\$ .25
Acid, hydrochloric .....	.06
Acid, nitric .....	.14
Acid, sulphuric .....	.06
Ammonia, aqua .....	.23
Ammonium carbonate .....	...
Ammonium, chloride .....	.55
Ammonium hydrosulphuret .....	.30
Ammonium sulphate .....	.15
Arsenic, white .....	.27
Copper, carbonate, annhy .....	.50
Copper, sulphate .....	.22
Cobalt, sulphate .....	.20
Iron perchloride .....	.40
Lead acetate .....	.35
Nickel ammonium sulphate .....	.25
Nickel carbonate .....	.32
Nickel sulphate .....	.35
Potassium carbonate .....	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.) .....	1.45
Silver nitrate (per oz.) .....	1.20
Sodium bisulphite .....	.15
Sodium carbonate crystals .....	.05
Sodium cyanide, 127-130% .....	.40
Sodium hydrate .....	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate .....	.18
Tin chloride .....	1.75
Zinc chloride, C.P. ....	.80
Zinc sulphate .....	.15

Prices per lb. unless otherwise stated.





## Something New in a Tapping Device

The only Tapper that has the Oscillating Motion, Imitating the Hand Motion, but 10 times as fast.

Now mechanical tapping is a demonstrated success. In hundreds of plants slow and costly hand-tapping is a thing of the past, for used in these plants is this

## Wahlstrom Attachment

This Automatic Wahlstrom, attachable to every type of drill press, will tap holes as squarely as they could be drilled. Controlled by the average operator, it will tap 10 times as many holes as an expert hand-tapper. Its mechanically obtained oscillating movement imitates hand-tapping at 10 times hand-tapping speed—and it actually reduces tap breakage.

Nothing about this Attachment can get out of order. Parts are hardened and ground steel. It takes taps of all sizes up to 1/2-inch.

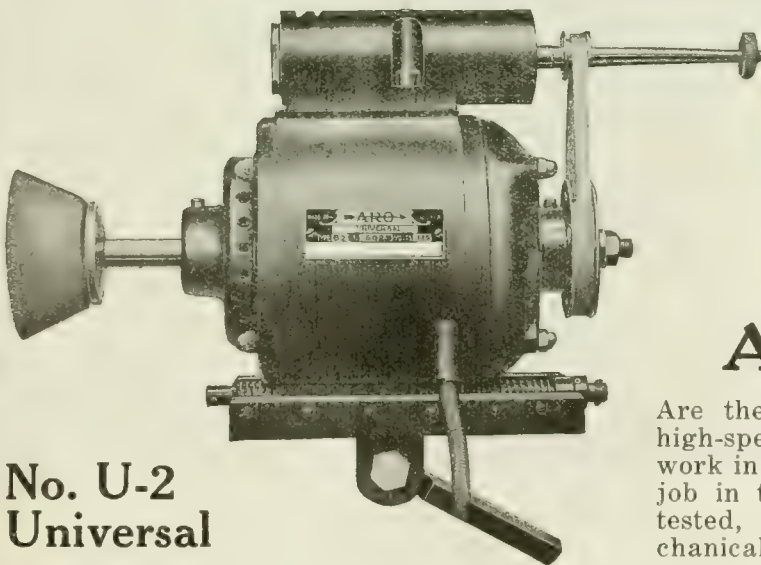
Send to-day for Bulletin.

*Aikenhead's*

**AIKENHEAD HARDWARE LIMITED**

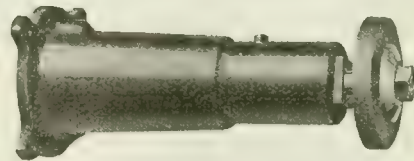
17, 19, 21 Temperance Street

Toronto, Canada



### No. U-2 Universal

Making ring and plug gauges, all styles of limit gauges, this Grinder accomplished what more than one user has designated "wonders." Used for lapping and finishing purposes it has proven itself to have no match. It develops 1/3 H.P. and has an Armature speed of 10,000 R.P.M. and an "A" Arm speed of 30,000 R.P.M.



## *Aikenhead's* Aro Grinders

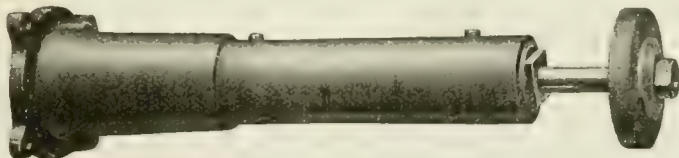
Are the most powerful, dynamically balanced, high-speed Tool Post Grinders you could put to work in your plant. They will handle almost any job in the largest shop. Thoroughly tried and tested, and absolutely guaranteed against mechanical and electrical defect.

In Aro Grinders you will never find either end play or vibration. The use of an Aro with Extension Arm Attachments would both improve and speed the work of your tool room.

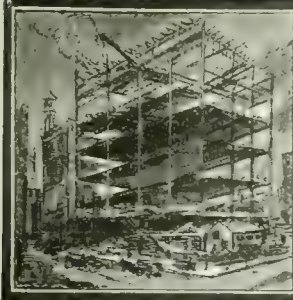
Just send for Bulletin.

**Aikenhead Hardware Ltd.**

17, 19, 21 Temperance Street  
TORONTO







# INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS  
PERSONAL AND TRADE NOTES



## THE INDUSTRIAL NEWS OF MONTREAL

War requirements have materially assisted in the development of the mining industry of the Province of Quebec. It is very well known that the province is not a favored mineral region, but necessity knows no law, and the past four years has shown substantial increase in general production. The general run of mineral ores are low in grade or in small or isolated deposits, that their extensive development is not at present profitable. The three leading products are asbestos, copper and sulphur ore, and cement. The total value of minerals mined in 1918 was nearly 19 million dollars, this representing an increase over the year 1914, of upwards of 50 per cent.

The International Metal and Trading Co., of Montreal, have opened offices in the McGill Building, to carry on an extensive export and import business. The complete organization of the new company will be consummated in a short time. Further announcement will be made in next week's issue.

The planning for the establishment of commercial air routes is proceeding apace. The latest report in this connection is to the effect that B. C. Howard, of B. C. Howard and Co., which has extensive lumber interests at English Lake, has recently purchased a "bus" from the United Aircraft Corporation, for the inauguration of an air route between Sherbrooke and English Lake.

The Canadian fleet patrol, which has been stationed at Halifax during the period of the war, has been acquired, by purchase, by Messrs. Hayes and Anderson, of New York. This firm is extensively engaged in the production of fish oil, fish scrap and fertilizer, and by the acquisition of these boats will be in possession of seven of the fastest steam propelled fishing craft in the world. These vessels have a speed of fifteen knots, and were formerly owned by Peters, White and Co., New York, and Wilcox Fertilizer Co., of Mystic, Conn.

The Montreal Pattern Works has opened offices and factory at 242 Clarke St., Montreal, Que. Operations are now in progress, and the firm is prepared to manufacture patterns of any description and for any purpose. Mr. Geo. Underwood is the managing-director.

Included in the estimates that the Government will have to consider at the coming session is the appropriation of about 80 million dollars for work on the

Canadian National Railways, and about 30 millions for the shipbuilding program. Many other smaller appropriations will also require consideration.

Kayser, Ellison and Co., steel merchants, are enlarging their Montreal warehouse by taking in the adjoining store on Craig St.

The Cornwall Board of Trade, in co-operation with the Town Council, are taking steps to send a delegation to Montreal to interest the authorities in the construction of bridges over the Ottawa River at Ste. Anne and Vaudreuil.

Williams and Wilson, of Montreal, are moving from their old location on St. James St. to their new offices and warehouse at 84 Inspector St.

The Beaver Engineering Co., of Montreal, are offering for sale their entire plant equipment.

P. M. Draper, of the Trades Congress of Canada, has returned from Europe, after about four months' activities in connection with the Peace Conference. In the opinion of Mr. Draper the affairs of labor will be conceded a more important place in the world's politics than ever before.

## ENGINEERING

**Niagara Falls, Ont.**—Water for the first time has been turned into the new Hydro thirteen and one-half foot water main through Victoria Park, which will give the Hydro fifty thousand more horsepower.

**Montreal.**—There is a persistent rumor that the Canadian Pacific Ocean Services may shortly purchase the whole fleet of an important English steamship line which controls a large proportion of trade between Great Britain and the East.

**London.**—The Board of Education will call for tenders at an early date for the erection of a new eight-roomed building on the Collegiate Institute grounds, in which commercial classes will be accommodated. The Collegiate has outgrown its present quarters. It is expected that the new building will cost in the neighborhood of \$50,000.

**Niagara Falls, Ont.**—At a meeting of engineers of Niagara district at Lafayette Hotel, Niagara Falls, a branch of the engineering institute in Canada was formed with these officers: C. D. Blanch-

ard, of Hydro Canal, president; N. P. Near, City Engineer, St. Catharines, vice-president; P. Johnson, St. Catharines, secretary; N. R. Gibson, Niagara Falls; W. H. Sullivan, St. Catharines; A. J. Grant, St. Catharines; H. W. Balfour, Welland, and H. L. Burke, Niagara Falls, executive.

## TRADE GOSSIP

**Want Canadian Plant.**—F. C. Austin Co., Inc., 609 Railway Exchange, Chicago, Ill., advise CANADIAN MACHINERY that they want to make arrangements with some firm in Canada with a view of having their line of machinery manufactured and sold in Canada for the Canadian market. The line consists of excavating machinery, trenching machines, concrete mixers and concrete roadmaking machinery, multipedal farm tractors, etc. Those interested should address the firm at the address given above.

**Australia's Attitude.**—Government officials at Washington were seeking an official explanation of the report that Australia had prohibited the importation of all except British products. Inquiries from American manufacturers who expected to expand their trade in Australia, flooded the Department of Commerce. In the absence of official information, commerce officials were inclined to doubt the accuracy of the report. But they have instituted an investigation through trade and diplomatic channels to find whether the Australian orders limit importation to British manufactured goods.

**In New Premises.**—Williams and Wilson, Montreal, are now entirely removed into their new building on Inspector street, and within a short time expect to be completely settled. The finishing touches are now being placed on the interior finishing. Every facility has been acquired to economically carry on their largely increasing business.

**Changes Made.**—The third reading has been given to Hon. Mr. Mercier's bill to amend the Quebec Mining Act. One of the amendments provides for the fixing of the duration of the scope of mining licenses for the territory known as "New Quebec," together with the terms on which they are to be issued and renewed. Changes affecting royalties have likewise been made so that now there will be no allowance for the cost of extraction. Previously, this cost was deducted from the value of the minerals.



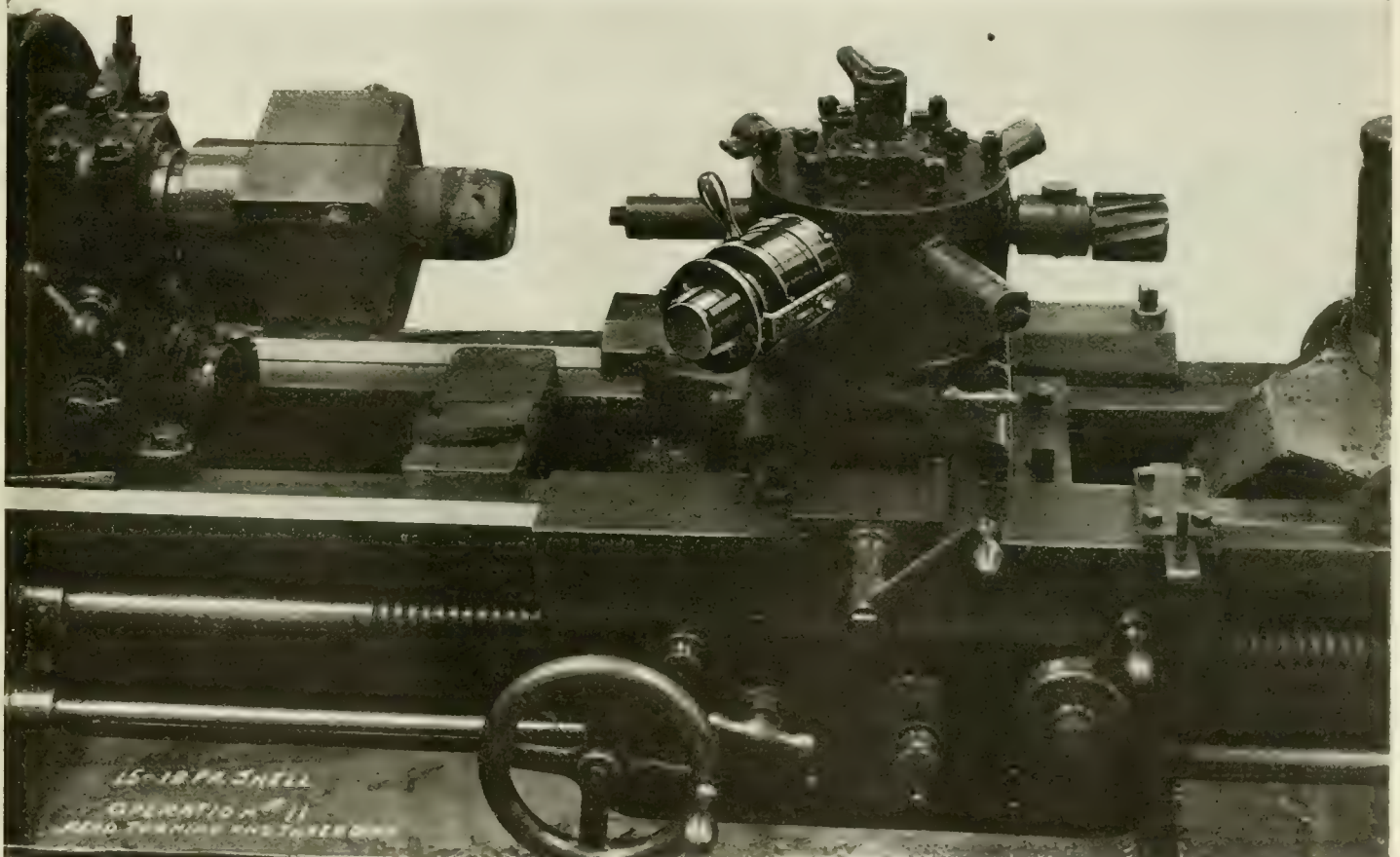
# ANOTHER GEOMETRIC FEAT

## DESCRIBED IN A LETTER FROM CANADA

Messrs. Geometric Tool Company,  
New Haven, Conn., U.S.A.

Gentlemen:—

"The engine lathe shown in the photograph which we are sending you commenced work on shells within four months of the start of the war, when methods were in course of development, and special machines were unknown. Material and labor were both frequently unsatisfactory. Rejections due to poor threads were



frequent troubles with shell makers. Despite many adverse conditions the contract was successfully completed, and the Geometric Tap used on this lathe (fitted to cross-slide on carriage) was an important contributing factor in the good work done in the early strenuous times."

Very truly yours,

---

Whether yours is a tapping or threading job, or both, you would be satisfied with the Geometric way of doing it.

**The Geometric Tool Company, New Haven, Conn., U.S.A.**

Williams & Wilson, Ltd., Montreal.

CANADIAN AGENTS:  
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B.



**Two Offices Opened.**—The Betts Machine Co., Rochester, have established branch offices at New York and Chicago. The New York office is located at 50 Church Street, with F. C. Severin in charge, and the Chicago office at 549 Washington Boulevard, with A. W. VanBuren in charge.

The Gwilliam Company, New York City have sent out a new catalogue descriptive of their ball and roller bearings. This catalogue lists the various types of ball bearings made by this firm, and also features a pressed steel line of which the Gwilliam Company are the patentees. Roller bearings are also shown.

**Foundry Sold.**—Mr. W. B. Cochrane of Vienna has purchased the Tilsonburg foundry and machine shop, which has been closed for several months. He is now putting it in shape and will reopen next week. Mr. Cochrane served his time with the late H. F. McCrae and is therefore familiar with both the shop and territory. He purposes doing a general line of repair work and castings, and will employ a staff to meet requirements of the business.

**Sarnia Industry.**—The H. H. Robertson Company of Canada, capitalized at \$200,000, has purchased the plant of the Sarnia Metal Products Company at Sarnia, Ont., and plans to commence operations about May 1 on the manufacture of asbestos covered steel roofing and siding; also ventilators, gutter and down pipes, skylights and asphalt paint. The officers of the new concern are: President, H. H. Robertson, Pittsburgh; vice president, Jas. Playfair; secretary, R. I. Towers; Treasurer, N. S. Gurd; managing director, C. McKenzie. The new managing director was formerly with the hardware firm of Mackenzie, Milne & Co., Limited, of Sarnia.

**Cannot Compete.**—The statement made through the press recently to the effect that the immense soda ash products plant of the Brunner, Mond Company, at Amherstburg just approaching completion, would not for some time at least, begin operations because of uncertainty regarding the Dominion tariff, received further enlightenment at a meeting of the Chamber of Commerce at Windsor, when the matter came up for discussion by the industrial section of the board. It was explained that the ending of the war had greatly lessened the demand for soda ash, and that the Amherstburg concern admitted its inability successfully to compete with the many similar plants now in operation in the United States, because the latter are able to ship almost unlimited quantities of ash into this country duty free except for the 7½ per cent. war tax. It was suggested in the form of a resolution that the Amherstburg concern should be offered some measure of relief by the Dominion Government in order that they might be able to begin work. The Amherstburg plant was built at a cost of several million dollars, and was expected to provide employment for several hundred men.

**Niagara Falls, Ont.**—A new radio compass, the invention of a Niagara Falls, Ont., man, William Lorenz, a jeweler, is now in use for the first time in the United States navy. It was first used on the George Washington, conveying President Wilson to France. Mr. Lorenz invented a device in 1916 for the detection of the presence of submarines. In a fog if another ship should come within the radius of the President's ship its presence will be indicated by the ringing of a bell.

## AIM TO SAFEGUARD MERCHANT MARINE

### Legislation to be Asked Covering Many of the Points Now in Dispute

At the meeting of the executive of the Canadian Merchant Service Guild the reports showed the institution to be in a first-class condition financially.

After a short address by the chairman, Capt. R. D. Simpson, of Owen Sound, it was decided to place the following legislation before the Parliamentary Committee:

(1) That the Government be asked to create a fund which will give seamen free hospital attention when necessary, the same privilege to be extended to fishermen and lighthouse-keepers.

(2) That all bridges across Canadian rivers and canals be provided with suitable signals to inform those in charge of a vessel that such will be opened before approaching close enough to endanger life and property.

(3) That every Canadian vessel be officered by Canadians, and that every such vessel leaving port be in charge of a certified person.

(4) That every Canadian vessel of 500 tons or over be provided with a master, first officer and second officer, and that every Canadian vessel less than 500 tons and operating more than 12 hours per day, with the exception of vessels employed solely in fishing, shall be provided with a master and one officer, these officers to be recognized as such by the Government.

(5) That every Canadian vessel be manned as may be found necessary to the safety of public life and property afloat.

(6) That Canadian coastwise trade be reserved solely for vessels truly and without fraud owned by the communities of Canada.

(7) That our Canadian Shipping Act be revised to conform to the necessities of our mercantile marine.

(8) That every master, pilot and officer who considers himself not fairly dealt with by our courts of enquiry shall have the privilege of appealing to the Admiralty Court for final decision.

(9) That a ruling be given regarding the articles supplied to our coasting vessels, as it contains the insignia of the British Empire, and at present people do not seem to understand its importance.

(10) That our Government be asked to introduce legislation which will give all

seamen of Canada the use of their franchise.

(11) That Otter head light, on the north shore of Lake Superior, be immediately put into commission, and a fog signal installed at that point.

(12) That our Government without further delay take up the matter of installing life-saving stations equipped with wireless, more especially along the north shore of Lake Superior.

It was decided that the nautical school in Collingwood be put under the auspices of the Canadian Merchant Service Guild, and that such educational institutions be inaugurated throughout the Dominion as soon as the progress of the institution will allow.

Capt. D. J. Stitt, Capt. A. McIntyre and Capt. A. Bakter were appointed as an Advisory Board for the year 1919.

## THE TORONTO YARDS LETTING MEN OUT

### No Contracts in Sight and Reductions in the Staff Have Been Made

The Polson Iron Works and the Dominion Shipbuilding Co., both of which employ large numbers of returned men, are gradually reducing their staff because of the lack of orders on hand and no promise of further contracts in the immediate future. The Polson Iron Works released 150 men, and Col. J. B. Miller said that when the present contracts on hand were completed, more men would have to be let out.

"It is quite true," said Col. Miller, "that we are letting 150 men out today. We have got to have orders ahead of us to continue our organization and two berths will be empty in April with nothing in prospect to go on with." Col. Miller stated that the company had received no orders from the Dominion Government at any time during the war, and that such orders as had been filled were placed by the Imperial Munitions Board and Norwegian interests.

"Several weeks ago," said Mr. A. C. McMaster, of the Dominion Shipbuilding Company, "a number of us went down to Ottawa to get the Government, if possible, to do something to keep 4,000 men employed in shipbuilding operations in this city. After five weeks we arrived at the point last Saturday when we had to let 150 men out, whereas, if we had had any assurance that contracts were coming to us we would have put these men on work in anticipation."

**Toronto.**—Mr. Justice Hodgins at Osgoode Hall gave an important Admiralty judgment in the action by the Carow Trading Company, of Cheboygan, Mich., to recover against the barge "Ed" the charge of towing the barge from Sault Ste. Marie to Calcite, Mich., and back again. The point at issue was whether the contract entered into by telephone was made in the United States or in Canada. The plaintiffs telephoned from Cheboygan to Captain Climie at Sault Ste. Marie, who accepted their terms. His Lordship decided that the contract was made in Ontario and was half carried out in Canadian waters.





## *The Specifications Call For .0001±*

**S**UPPOSE you were studying the specifications for a big job—one that called for making new and expensive tools—would your present tool-room equipment let you handle it? There are only two kinds of tools—the good and the poor—there's no half-way mark. And the quality of your output is fixed by the degree of accuracy you can obtain in your tool-room.

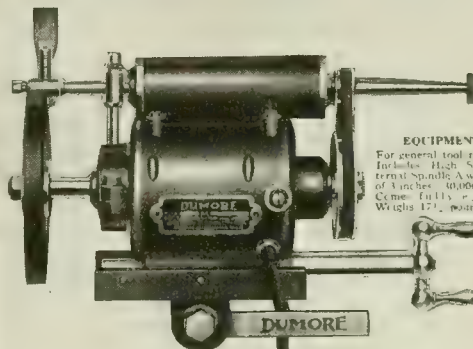
Accuracy in grinding depends upon correct cutting speed and perfect running balance. That is why the **DUMORE** grinder has been given speeds ranging from 10,000 to 50,000 R. P. M., along with a dynamically balanced armature. With this tool in your shops you can eliminate chatter, taper or bell-mouthed grinding. Then, too, the **DUMORE** is portable, easily carried to all parts of the shop and quickly set up in any machine ready for use.

If you are interested in obtaining only the best tools, ask your dealer about the **DUMORE** grinder. If he doesn't carry it, write us for literature and prices.

WISCONSIN ELECTRIC CO.

2909 16th St.

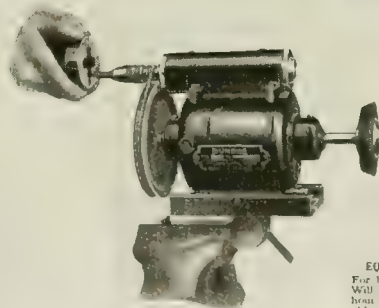
RACINE, WIS.



**EQUIPMENT A**  
For general tool room use  
Includes High Speed Inter-  
nal Spindle with reach  
of inches 0.0000 R.P.M.  
Comes fully equipped  
Weights 17½ pounds



**EQUIPMENT B**  
For deep internal  
work. Extremum  
arm has 10 inch  
reach. 10,000 R.P.  
M. Arm inter-  
changeable with in-  
ternal spindle on  
Equipment A.



**EQUIPMENT C**  
For button dies  
Will grind 20 an  
hour. Interchange-  
able with A and B

# DUMORE HIGH SPEED GRINDERS



## TALK OF PIG IRON BEING CHEAPER IS HOLDING UP BUSINESS AT PRESENT

HERE has been so much talk at United States points of reducing the price of pig iron from \$31 to \$28 that very few sales are being made. Purchasers are using only what they need and are not going into the market buying for their future requirements, fearing that they should be caught between the \$31 and the lower prices. There is a feeling in a good many places that the discussion of the lower price levels is being carried on too long, and that an announcement should be made at once with something definite covering a period of months. The reports from some of the producing points are as follows:

**PITTSBURGH**—One curious result of price shading has come to light here in a deal that has just been finished. One producer offered to supply pig iron as low as \$28 per ton. It was thought that such a figure would produce considerable business, but instead the buyers who were approached on this scale stated that if the price were brought to \$28, they would rather stay out for a while until the next cut had been made, so apparently they anticipate that the price may go even lower than that figure.

**PHILADELPHIA.**—Cost of production at various points is being discussed to a very great extent here, and some of the figures furnished are as follows: Pittsburgh District, \$23 to \$25; Buffalo, somewhat higher; Eastern Pennsylvania, \$25 to \$28. It will be seen from these figures that if any action is taken toward bringing prices to a very much lower level, it will mean that a good many of the furnaces will be blown out as it will be impossible for them to operate.

**NEW YORK.**—The fixing of prices seems to be the chief item in the market here at the present time, and although nothing definite has come up, there seems to be a general feeling that \$25 will be the price agreed upon. In one case where customers desired to cancel orders from an eastern furnace they had to pay the difference between the contract price and the present market price before the business of cancellation was agreed to.

**CLEVELAND.**—The demand here at present for iron is very poor, and in some cases there has been a call for tonnage on the road to be held up, as it only means further piling in the foundry yards. Several of the buyers report that they have received concessions from some of the makers, bringing the price down to \$28, against the \$31, which has been prevailing for some time.

**BUFFALO.**—One of the large producers of pig iron here had his furnace down recently for re-lining but this interest now finds that the other two stacks that are in operation can take care of all the business, and it is unlikely that the third furnace will be put in operation for some time.

**CHICAGO.**—The coming into the mar-

ket of the railroad shops would bring orders for supplies, would do a very great deal to help the market along at the present time, but apparently the roads are not going to come in until a lower price has been reached. That seems to be the general consensus of opinion here. It would be quite correct to say the pig iron market price is absolutely dead.

**ST. LOUIS.**—The producers of pig iron in this district are not going to pile any more material in their yards. That announcement is taken to mean that they are going to produce only as much as they can sell. When sales are not sufficient to keep the yards moving they will shut down. The reason for this is that they fear a lower level is coming in prices and they do not wish to go ahead and produce material that is going to cost them more than they can sell it at. Another stack in this district has gone out and before the end of the month it is likely that two others will follow suit.

## RAPPED CANADIAN PATENT OFFICE

**Montreal Speaker Said That It Imposed  
Nothing More Than a Tax  
on Brains**

A strong criticism of the Canadian Patent Office, and suggestions for remedying defects, were contained in a paper read by H. A. Budden, A.E.I.C., at the meeting of the Montreal branch of the Engineering Institute of Canada.

Up to the present, said Mr. Budden, nearly 4,000,000 patents had been issued in the world, Canada issuing 188,000, Great Britain issuing 515,000, and the United States issuing 1,292,000. Unlike Great Britain, the United States and France, Canada did not classify her patents, he said; neither did she print patent specifications, and the cost of a typewritten copy of a patent was exorbitant. Mr. Budden pointed out a number of instances where, he said, the patent office could improve its procedure so as to afford greater and clearer information to the public, thus making the record as useful and complete as possible.

The financial position of the Patent Office was curious, he said. For the year ended March 31, 1918, there was a balance of receipts over expenditure of \$101,520—and, said he, it was an injustice from a public point of view that the patent office should make a large annual profit out of the fees paid by inventors. It was merged in the ordinary revenues of the country and was a veritable tax on brains. The strain of protecting and maintaining patents was proved by the frequency with which patents were dropped merely in order to save renewal fees. The Canadian Patent Office had in the past been a milch cow supplying the Government with a large amount of funds, he said. The Patent

Office could be made a more useful institution than it was at present, it being now chiefly occupied in granting monopolies to others than Canadians. Last year only 973 patents out of 7,238 were granted to Canadians.

## NEW STEEL TO BE MADE AT WELLAND

**Company Claims to Have a Process That  
Is Better Than Nickel Steel**

**Welland Telegraph.**—A new industry is starting to Welland that in some respects will revolutionize the manufacture of nickel steel. The concern is the Nicu Steel Corporation, Limited, with offices in Toronto and New York. H. A. Morin is the local manager and W. Burkinshaw is the sales manager.

Originally nickel steel, which is used for armor plates, guns, safes, etc., is made by adding nickel to the steel in a molten state. Under the Colvocoresses patent, which this concern will operate, the nickel ores are mined at Sudbury and roasted to get rid of the sulphur. The ore is then shipped to Welland and smelted by an electric furnace, and run into pig form, which will be a combination of iron, nickel and copper. This pig metal is then remelted with steel turnings in another electric furnace and nicu or nickel copper steel is produced. This is then cast in the form of axles, shafting, gears, automobile parts. Orders are on hand now for export shipment.

Hitherto copper in steel has always been considered a great detriment to its strength. By this new patent process the copper is used to enhance the strength and durability of the steel. In this sense it's a radical change in nickel steel.

The Electric Steel and Metals plant will be used to make nicu steel for the present.

The company at present is making preparations arranging the plant suitable to the process. Fifty men will be employed and a great many more as business increases.

**Yarmouth, N.S.**—An ideal launching took place from the shipyard of Capt. Omer Blinn at Grosses Coques, Digby Co., when a handsome stern schooner of 440 tons net was put afloat for Mr. F. K. Warren, of Halifax. This splendid vessel is most thoroughly built and fastened to comply in every particular with the French Veritas in which she is classed for twelve years. Her cabins are beautifully finished in ash and are most modernly equipped with every convenience for the comfort of her officers and crew. As the vessel slid down the ways she was christened Maid of Scotland by Mrs. Haughn, wife of Capt. Wallace Haughn, of La Havre, who will command her. Capt. Blinn's yard has been a busy centre all through the present boom in shipbuilding and promises to be for some months to come, as he is already making preparations to build a 700-ton barkentine for Mr. Warren.



## PERSONAL

A. R. Williams Co., of Montreal, are expecting to take possession of the building on St. James St., recently vacated by Williams and Wilson, on or about the first of May.

E. N. Davey has been appointed tool room foreman of the Montreal plant of the United Shoe Machinery Co. During the war Mr. Davey held a similar position with the Dominion Bridge Co.

David A. Gordon, ex-M.P., of East Kent, and prominent manufacturer of Wallaceburg, died at Braithwaite, La. He had been associated with the Wallaceburg Cooperage Co., Sydenham Glass Works, Wallaceburg Brass Works, Dominion Sugar Co., in addition to extensive other interests.

One of the most widely-known mariners of the Great Lakes, Captain Edward Robertson, passed away at the Alexander Apartments at Sarnia in consequence of a stroke of apoplexy suffered about two weeks ago. For about thirty-five years he was associated with the old Beatty Line and the Northern Navigation Co., and was master of many well-known steamers of those times. He had been living retired for the past few years.

Alf. J. Roberts, engine foreman of the G. T. R. at Turcot roundhouse, Montreal, was killed last week by an Italian, who had been discharged a short time before for inefficiency. Mr. Roberts had been in the employ of the Grand Trunk for many years, serving his time in Stratford, and holding the position of gang boss and erection foreman for several years.

## MARINE

Toronto.—The freighter General Morrison was added to the Canadian mercantile trade when the formal launching ceremony was held in the Dominion Shipbuilding Company's yards at the foot of Bathurst street. This boat, which is named after Brig.-General Morrison, one of Canada's returned soldiers, is part of a fleet of eight ships to be built for the Canadian trade. The freighter has a length of 261 feet, and has a carrying capacity of 3,550 tons. The christening ceremony was performed by Mrs. Louis Dahlgren, wife of the vice-president of the company.

## TENDERS

Peterboro.—Tenders will be received by Alderman Harry Phelan, Chairman Board of Works, City Hall, Peterborough, Ontario, up to 5 o'clock p.m., of Tuesday, April 1st, 1919, for the construction of a reinforced concrete bridge of eleven arches, with approaches, etc., over the Otonabee River, at Hunter St., Peterborough, Ontario. Proposals will be considered either upon a lump-sum basis or upon cost plus a lump sum basis. Plans and specifications may be seen at the office of R. H. Parsons, City Engineer, Peterboro, or at the office of Frank Barber, 40 Jarvis street, Toronto.

Toronto.—Sealed tenders will be re-

ceived until 12 o'clock noon Tuesday, March 25, for the train filling and concrete work on the Muskoka Subdivision between Mileage 130 and 149 (Parry Sound). The construction of concrete piers at the Seguin River Crossing on the Industrial Spur, Parry Sound, and the train filling and concrete work on the Sudbury Subdivision between Mileage 0 (Parry Sound) and 30, all of the work being in connection with bridge filling and ballasting. Drawings and specifications may be seen and forms of tender obtained at the office of the Engineer Maintenance of Way, No. 7 Adelaide St. East, Toronto; A. F. Stewart, Chief Engineer Eastern Lines, Canadian National Railways, 27 Wellington St. East, Toronto.

## MUNICIPAL

Halifax.—The city Board of Control opened tenders for furnishing to the city an aerial fire ladder truck and a salvage wagon, both motor driven. The American La France Fire Engine Co. offered to furnish a 75-foot, 105 h.p. ladder truck at \$17,909, or 65 foot at \$17,200, f.o.b. Halifax. The Seagrave Co., through Austen Bros., offered to furnish a ladder truck at \$17,210, f.o.b. Halifax. The Union Supply Co. offered a 75 foot ladder truck for \$13,600 f.o.b. at Grand Rapids, Mich., the city to pay duty and freight. The offers to furnish a salvage wagon were: Robinsons Ltd. (Reo), \$4,400, \$4,500 and \$4,175; White and Co., \$5,500 and \$8,850; American La France, 75 h.p. at \$8,250, and 105 h.p. at \$9,750; Seagrave Co., \$9,805 and \$10,370. The tenders were referred to Controller Hines, the city engineer, and the fire chief for tabulation and report.

## CATALOGUES

Forging by John Jernberg, The American Technical Society, Chicago

The art of blacksmithing is an ancient one and for centuries was the only method-working profession. Very little improvement has been effected in it up to comparatively recent times. In the last few years the adoption of new types of steel has made considerable advancement necessary in the art of forging and also in the allied art of heat-treating. The author states that this book was written for the bringing up to date of the machinist's knowledge concerning the art of forging in its more modern aspect. One chapter describes mechanical details, materials and equipments, and goes into the various types or forges, furnaces, annealing ovens, and power tools which are used. Forging operations are next taken up and the major portion of the book is devoted to this particular subject, welding, up-

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Write for Booklet.

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setting and other forging operations being all dealt with. Heat treatment and its effect on the physical properties of steel is an important subject and is covered in a simple and able manner.

The Crouse-Hinds Company of Canada, Limited, Toronto, have issued a four page folder called "Condulet Suggestions 64." This folder describes the use of their condulets and the arranging or the charging of storage batteries on the train lighting sets. In the installations the condulet is mounted on a concrete pedestal which both facilitates a plugging and insures against the condulet being frozen in or covered with snow during the winter.

The Graton and Knight Manufacturing Company, Worcester, Mass., have issued a very complete catalogue descriptive of the lines of belting, which they manufacture. The first few pages are taken up in the description of the plant and of the various portions of the hides which go to make up the finished belt. The various grades of belting are taken up next and each one of the different classes manufactured by the Graton and Knight Company are described in detail. Various types of belt drives are treated of and much valuable data is given regarding the proper calculation of belting problems and the care of the belts themselves.

Buckeye Products Company, Cincinnati, Ohio, have issued their general catalogue number 7. This book contains 400 pages and is a reference work on foundry tools and appliances. Practically everything which is necessary to the successful operation of a foundry may be found in the pages of this book, and a list of reference books is included which may be purchased through the Buckeye Products Company.

The Morse Chain Company, Ithaca, New York, for which Jones & Glassco, Montreal and Toronto, are the Canadian agents, have issued publication Number 16, entitled "A Chain of Evidence." This publication is one of the series and deals particularly with a small power drive. The book is replete with illustrations and is of interest and of useful reference for those who have to deal with the transmission of small amounts of power.

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— a man who can give his entire time to selling a widely advertised power house device. An intelligent, convincing talker, a man not afraid of work, a man who expects good pay for good work, is the man we want. We will respect your confidence. In the first instance, write fully to Box 564, Canadian Machinery.

The American Roller Bearing Company, Pittsburgh, Pa., have issued a catalogue descriptive of the Roller Bearings for all purposes. It deals particularly with the type C roller bearing manufactured by this firm which has been designed and manufactured in response to a large demand of high grade roller bearings at a moderate price.

#### BURNING WASTE

Waste of the most unpromising character can often be burned with success and utilized in the generation of steam, but special forms of furnaces are usually necessary in order to carry out the operation properly. Shavings, sawdust, bagasse, and spent tanbark are among the commoner forms of waste that are put to use in this way, and many cities are also generating steam by utilizing their refuse as fuel. The most important thing to do in burning waste, especially when it is damp or wet, is to handle the fires so that an abundant supply of air shall always be present, and a large surface exposed, over which the combustion can extend, and from which the water that the fuel contains can be evaporated. It is of prime importance, in handling wet material, to see that it becomes dried at least as fast as it is consumed; for if this condition is not fulfilled the dry part will burn up and the fire will then go out. In starting a fire that is to burn waste, it is usually necessary to run with some other kind of fuel until the furnace has become thoroughly heated. The waste can then be added a little at a time, until the mass has become well ignited and a considerable part of it has become dry. Furnaces for burning waste are preferably detached from the boiler itself, the combustion taking place in front of the boiler, or below it, in a separate furnace from which the heated gases are led to the boiler by means of suitable fire-brick passageways. By conducting the operation in this way, it is possible to feed the fuel through openings in the top of the furnace—which is far better than introducing it through the doors in the front of the setting, as in firing with coal. The fuel should be thoroughly stirred up and worked over as it dries out and burns upon the grates, so that fresh portions of it may be continually brought to the surface. It is often best to handle the waste by a conveyor of some kind, the form of which will naturally depend upon the nature of the material itself. Blowers are used with good effect for handling shavings and dry sawdust. Considerable skill is required in order to burn wet waste effectively, and men cannot be expected to obtain first-class results until they have had the necessary training and experience.

c 14 m



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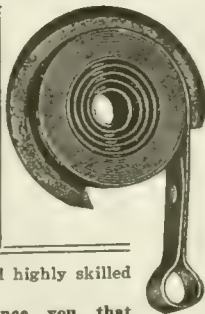
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## Financial Post THIS WEEK

"THE wiping out of the handicap which Canadian products met in the British market, and the granting of what is equivalent to a preference for Canada temporarily, at least should result in a great impetus to our immediate trade with the mother country. If permanent, as it is almost certain to be, if we keep men of the Borden, Lloyd Harris capacity on the job, it means tremendous immigration and the settling of millions of acres of farm lands. It means the extensive development of present and the establishment of numerous new industries in Canada, to take advantage of the preference; bringing in hundreds of thousands of mechanics and mine and forest workers. For example, the Canadian subsidiary of the U.S. Steel Corporation, which has been marking time, will, in all probability, now go ahead energetically with their twenty or thirty million-dollar plant development here. In fact, it is quite probable that within a week plans will be completed and action taken for the immediate erection of about 1,500 workmen's houses at Ojibway, Ont. As we go to press we read in cables to U. S. papers that scores of American manufacturers and other business developers who have been in Great Britain are returning home feeling that there is now little hope of overcoming the handicaps of prohibition of imports and preferences unless they establish branch plants in Canada or the United Kingdom."—"The Financial Post."

Besides the important article from which the above quotation is made, THE POST this week deals with the following amongst

#### OTHER SUBJECTS OF INTEREST

**F. P. Jones Speaks of Embargo Removal**  
Steel Trade is Now Waiting for Definite Prices

**The Waging of the Hydro War at Hamilton**  
Already West is Talking of Coming Crops  
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### CLEANING FIRES

Cleaning the fire of a hand-fired boiler is a somewhat elaborate operation, and it is performed in much the same manner, whether the coal is soft or hard. The present section describes the cleaning of a soft-coal fire, but it applies to hard coal also, save for a few changes that will readily suggest themselves.

The frequency of cleaning that is best adapted to any given plant should be determined by experience, because it will vary with the character of the fuel and with the rate of combustion per square foot of grate area. As a rule, a soft-coal fire needs cleaning oftener than a hard-coal one. The cleaning should be done rapidly, to avoid chilling the boiler unnecessarily, and the damper should be nearly closed, to prevent the entrance of large volumes of cold air through the fire doors. The fire should be allowed to burn low before cleaning.

The free, live, upper part of the front half of the fire, consisting mainly of good coal, should first be worked well back toward the bridge wall. The clinkers, thus left exposed on the front half of the grate, should then be loosened by pushing a slice bar under them, and removed from the furnace. When a dumping grate is used the clinkers are dumped directly into the ash-pit; but if the grate is a stationary one the clinkers must be drawn out through the fire doors and dumped on the floor, where they should be kept well away from the front of the boiler. If hauled out upon the floor, the hot mass should be immediately wet down, preferably with a hose, and special care should be taken to avoid splattering the water against the boiler front, or against any pipe or fitting containing steam or hot water. The bared portion of the grate should next be thoroughly cleaned, for if any lumps are left clinging to the bars the fire will clinker up again more quickly than it will if all such lumps are removed. The spaces between the grate bars should also be cleaned out as well as possible, because if obstructions are left there the flow of air will be correspondingly impeded, and the bars are likely to become warped and burned. The entire live, active part of the fire should next be pulled forward to the front half of the furnace, and the cleaning operation repeated upon the back half of the grate with the same care as before. If a dumping grate is used, the clinkers are dumped from the back of the furnace into the ash-pit; but if the grate is a stationary one they must be hauled (or "jumped") out over the fire and through the doors. When the entire fire has been cleaned, it should be evenly distributed over the grates and covered with fresh coal. If the furnace has a double door, one side of the fire should be cleaned and allowed to burn up again before the other side is cleaned.

The method of cleaning described above is the one ordinarily employed in American stationary practice; but if the coal clinkers badly it is better to shift the fire sidewise instead of pushing it back

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68? It will interest  
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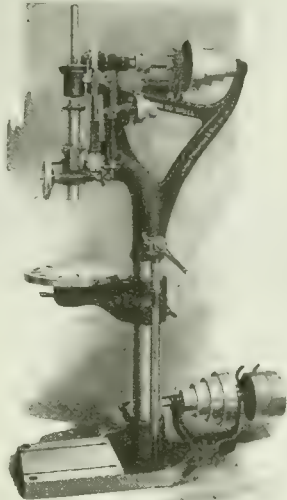
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- No. 4—B. & S. Plain Miller
- 1—36" x 36" x 8' Gray Planer, two heads
- No. 3—Cincinnati Universal Miller
- 5—No. 0 Steptoe Hand Millers
- 13" x 5' 6" New Carroll-Jamieson Quick-Change Lathe
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- 15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
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- 17" x 8' New National Quick-Change Lathe
- 3 17" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 19"
- 17" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 19"
- 18" x 24" New Rahn Larmon Lathe, D.B.G. Quick-Change
- 19" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 21"
- 9—19" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 21"
- 25" x 14' New Sidney D.B.G. Quick-Change Lathe, swing 27"
- 33" x 14' Putnam, arranged for Motor Drive
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- 5' Bickford Single Pulley Drive Radial
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- 30-ton Watson & Stillman Hydraulic Press

**FRANK TOOMEY INC.**

127 North Third Street

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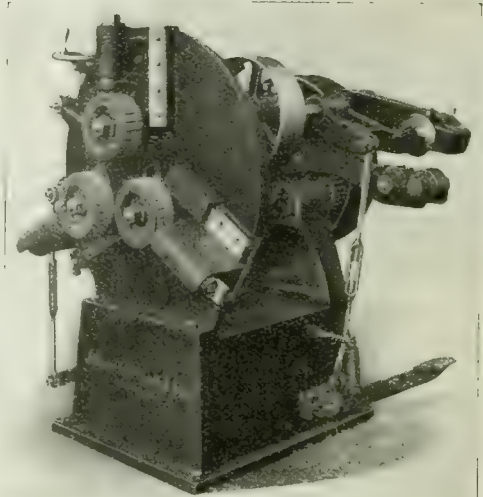




A light type drill, having hand wheel, hand lever and automatic feed.

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Complete equipment for  
Boiler Shops, Structural  
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or Machinery for any  
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A Universal Machine for cutting and cleaning from 1 1/2" to 6 1/2" flues.

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If you have a lathe  
a drill  
a milling machine  
a planer  
a chain block  
a chuck  
a motor  
a crane  
a stock of belting  
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a compressor

or any other machine shop equipment for which you really have no further use, why not turn it into *cash*?

Someone may be looking for just the machine you may want to sell. Let us bring you together.

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Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

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*Classified Advertising Section*

143-153 University Avenue TORONTO, ONT.



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Grind your cutting tools in exactly the right way to get best results—and you save time. That's obvious. It is precisely that that this Tool Grinding Chart enables you to do.

It has been adopted as standard by many firms that found it a long way better than guess work.

CANADIAN MACHINERY would like to see this Chart in every shop in the Dominion. Mail the coupon below for your copy to-day.

*Shows at a glance  
Correct Clearance  
and Rake Angles  
for Cutting Tools*

CANADIAN MACHINERY,  
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Please send <sup>me</sup><sub>us</sub> free, one of your tool grinding charts.

Signed.....  
Firm Name.....  
St. Address.....  
City.....  
Prov. ....



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**Henry and Wright Machines**

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ALL EQUIPMENT REQUIRED FOR RAPID AND ECONOMICAL  
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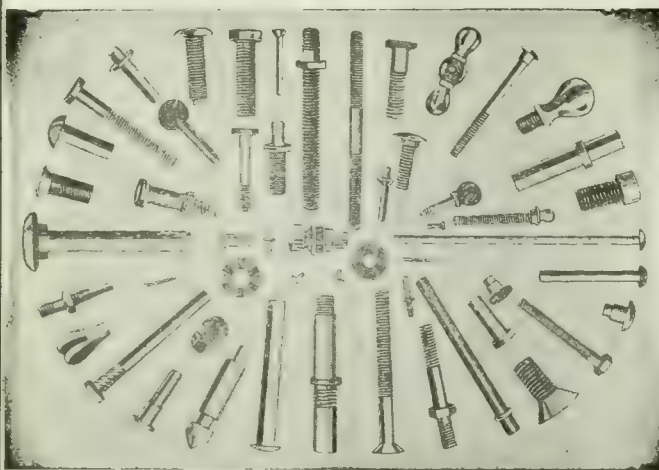
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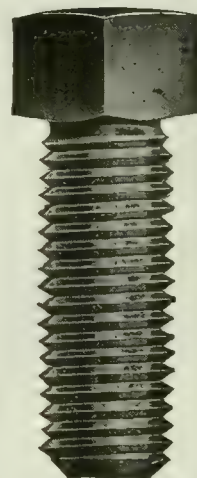
Our Mechanical Engineers are  
at the service of our Clients.

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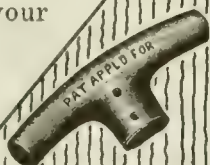
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6 Only 3 1/2 x 3/8 x 1"	1 Only 5 x 1 x 1 1/4"
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**National High Speed Slitting Saws**

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12 " 4 x 1 1/16 x 1	12 " 6 x 3 1/16 x 1
6 " 4 x 3 1/16 x 1	6 " 6 x 3 1/16 x 1 1/4
6 " 4 x 5 3/32 x 1	2 " 7 x 1 1/8 x 1
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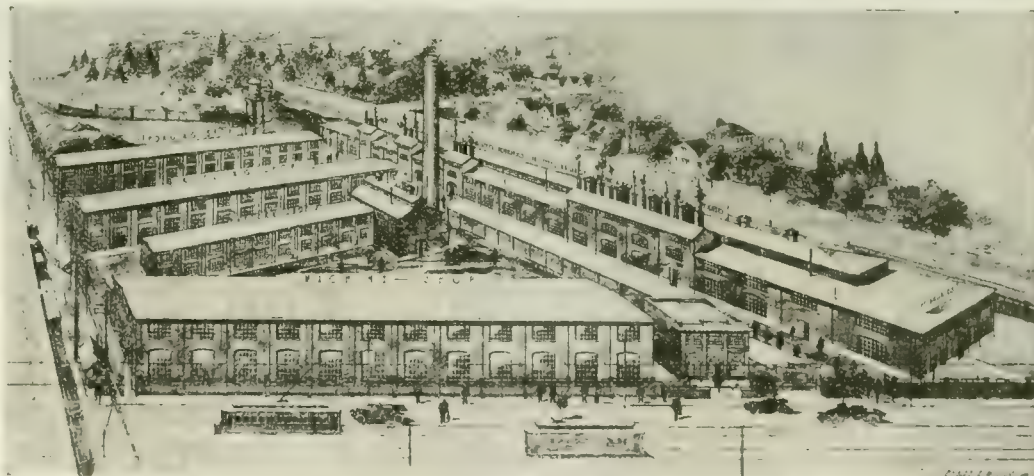
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This will place us in a position to handle orders big and small with unequalled facility.

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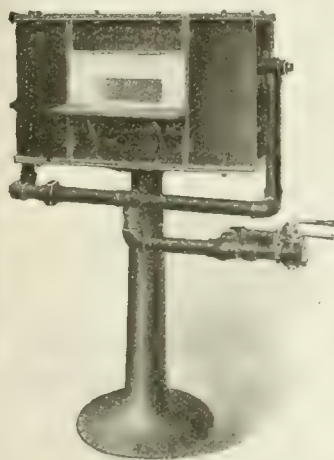
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*Immediate delivery on  
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Furnaces built for  
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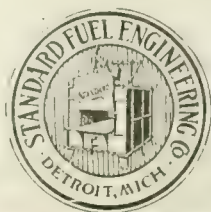


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For  
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Large Stocks maintained at convenient distributing  
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# Thor

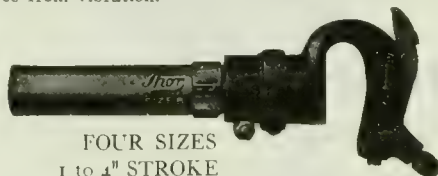
## CHIPPING HAMMERS

*Thor* Predominates wherever chippers are used because:

- 1st. The main valve is large in size and durable, being of the balanced type and having a bearing surface of three square inches.
- 2nd. Two square inches of the bearing surface retain the lubrication constantly, as no air passes over to blow the oil off.
- 3rd. The handle is equipped with a self-seating throttle valve, which eliminates all leaks.
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Drilling in concrete with a size D hammer with a hexagon nozzle. Will drill a hole one inch in diameter, at the rate of one inch per minute.



FOUR SIZES  
1 to 4" STROKE



Riveting Base Plates with size B hammer. Let our service engineer call at your plant and explain the various uses to which these hammers can be adapted, and how to obtain the best results on your particular work.

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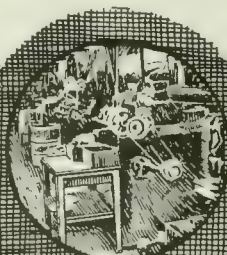
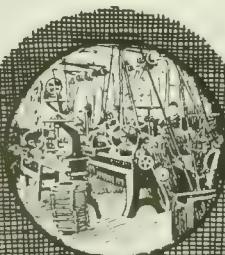
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Consult us on your machine problems

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— ACCURACY—RELIABILITY —

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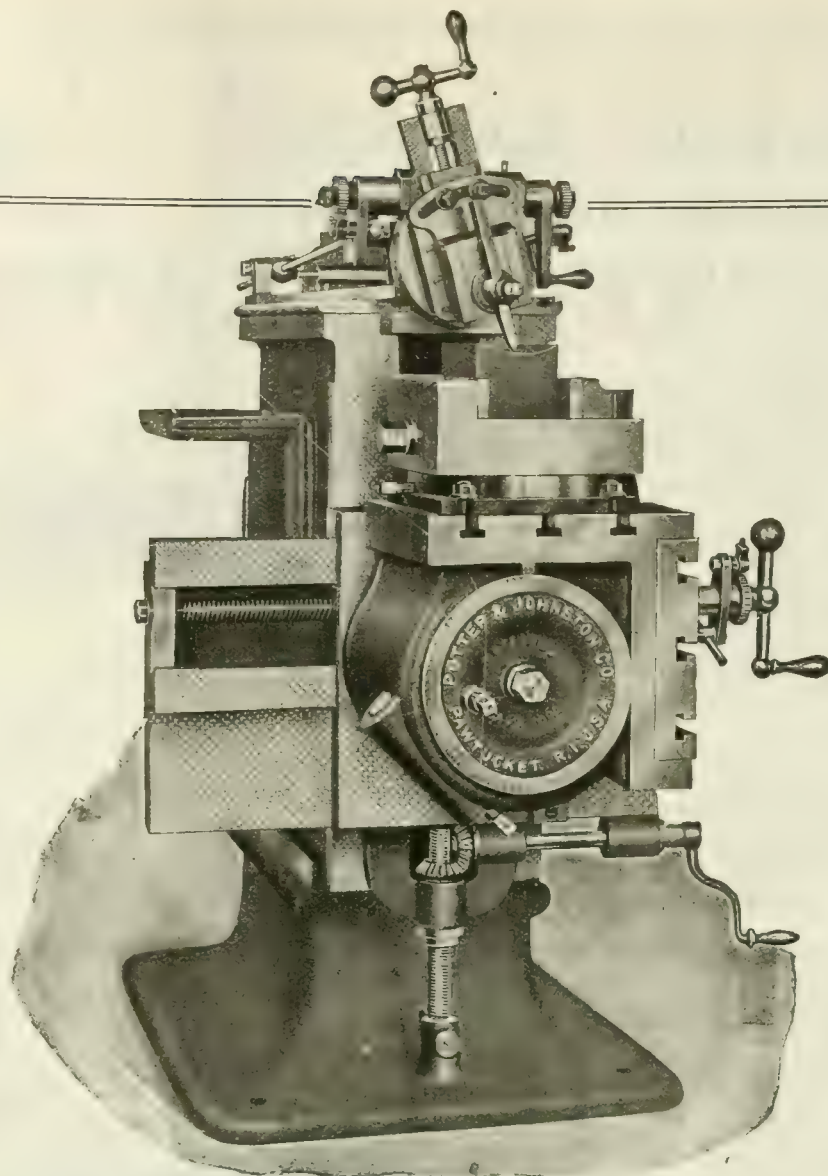
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**WE ARE GENERAL AND  
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Let us quote you on your requirements, and have your tools made as you want them made.

WOOD METAL PATTERNS  
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## Potter & Johnson's 15-inch Universal Shaping Machine

Simplicity of design, convenience, extreme care exercised in their manufacture, and the many universal features of the machines, combine to make the UNIVERSAL SHAPING MACHINES the most efficient and thoroughly reliable tools of their type on the market to-day, and place them in a class by themselves. The above illustration shows our 15" Universal Shaping Machine with Swivel table having auxiliary tilting side, power down feed on any angle, POWER ROTARY FEED for planing internal curves, automatic feed stop, graduated collars on tool head feed screw and table feed screw, swivel vise with graduated base.

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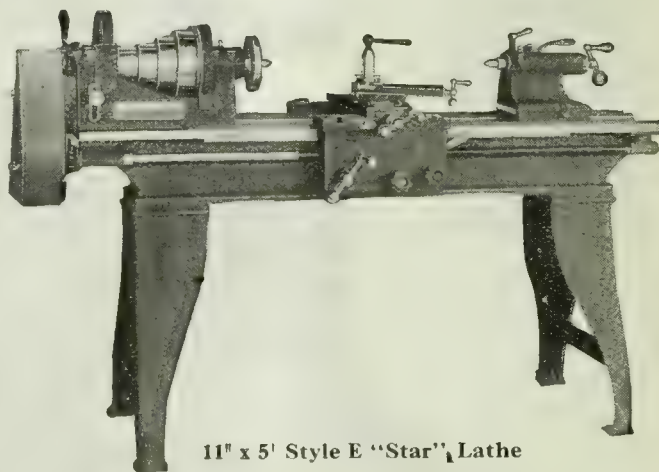
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11" x 5' Style E “Star” Lathe

“Star” Lathes are made in 9-in., 11-in. and 13-in. swing sizes with full line of attachments available.

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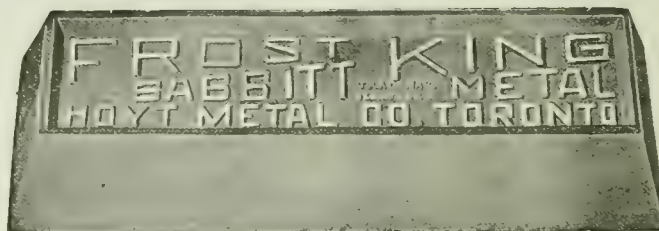
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Hoyt Metals have been used with great success for over  
Put them to the test and you'll soon see a difference in  
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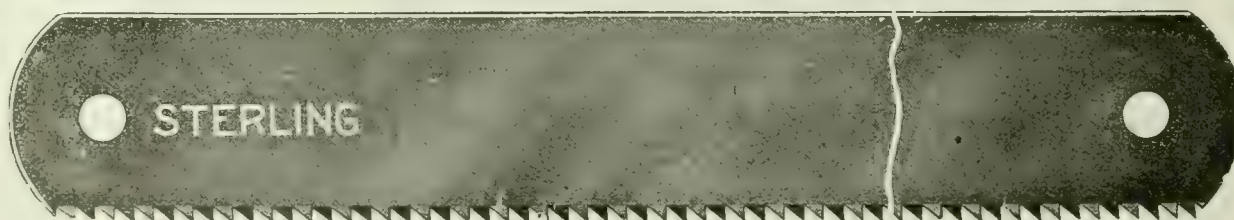
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## “STERLING”

## SAWS



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Don't waste your money, your time, your comfort.  
Don't put in your shop a lathe that won't satisfy.

## BUT

remember this—a CISCO Lathe will satisfy; it will relieve you of all shop worries; it will save you time; make you money.

## WHY?

It is the only lathe with the pull. The only lathe of simplified accuracy.

Made in 14", 16", 18", 24" sizes.

Cone Driven, Motor Driven, Geared Head, Motor Driven Geared Head

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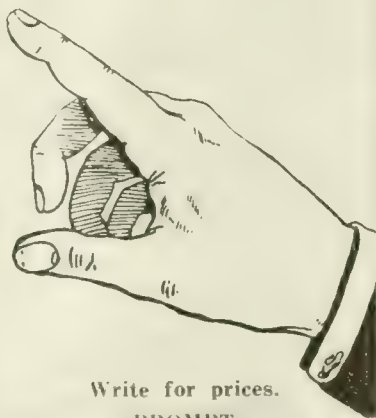
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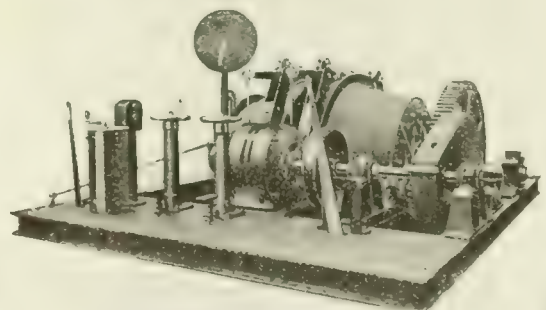
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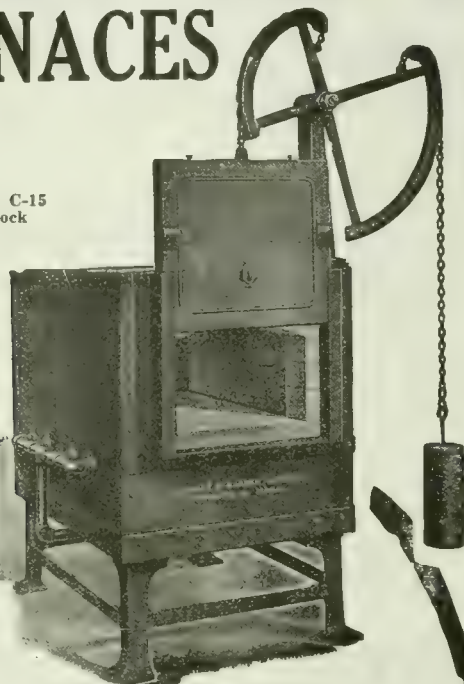
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Type C-15  
in stock



## Shipped on Receipt of Order

If additional proof was required of the efficiency of Gilbert & Barker's heat treating furnaces, this proof was generously supplied during the World War. Industrial plants throughout the United States and Canada engaged on war contracts covering the manufacture of munitions, ordnance, airplanes, motor trucks, tanks, etc., found it necessary to secure on short notice a thoroughly efficient furnace. As designers and builders of heat treating furnaces for a period of more than 50 years it was quite natural that the demand for G & B equipment should be heavy.

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## Testing Williams' Superior Drop-forged Wrenches



### The Pull

*Wrenches in stock, all designed for specific purposes.*

Box — Hex. and Square  
Cap Screw — Hex. & Square  
Car Carriage  
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Set Screw Short Socket Spanner Straight Structural Textile Machine Tool Post Track Triple Head

Limited drop-forging knowledge and skill didn't make these wrenches *Superior*.

Nearly half a century ago when this company launched the first standard line of Drop-forged Wrenches, mill-ed with curved-base openings, it caused little comment, *but the Williams' curved base line lived!* It removed the starting point for breakage incident to all wrench openings with angles at the base — to-day the curved base is copied generally.

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40 patterns in about 1,000 sizes with widths from 3-16 to 7 5-8 inches. Ask for Booklet



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# Smalley General Thread Milling Machines

Two speeds—in one minute milling 2 to 12 inches or turning 15 to 30 feet.

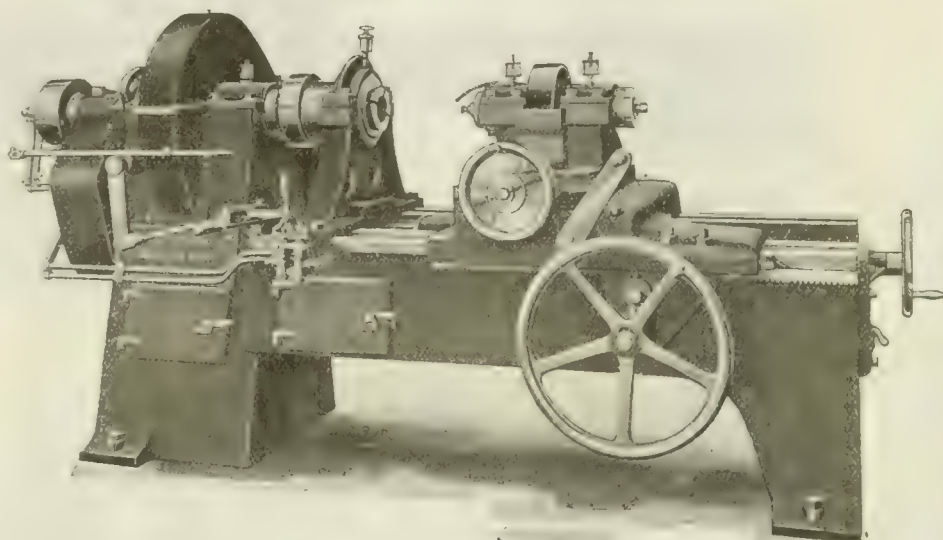
Don't misunderstand **Peace**. It is not a signal to put on the brakes.

Now, if ever, your shop needs Smalley General Thread Milling Machines to meet commercial rivalry ahead. They are guaranteed to increase output 50%.

Speed extraordinary while on extremely accurate work won Smalley General Thread Millers the unstinted praise of the largest producing shell-makers on this continent. The same ability will prove a profitable advantage in your commercial shop.

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**Smalley General Co., Inc.**  
BAY CITY, MICH.



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*To Your Sense of Economy and Efficiency?*

It's economy — requires one-half the space; costs less than half; no chimneys or flues required; instantaneous and perfect control of temperature; higher temperature obtained; no coal ash handlers required; no coal or ash piles; less waste of fuel, because it is shut off instantly; requires much less time to get the required heat. *Can you afford to lose the Advantages of this oil Furnace?*

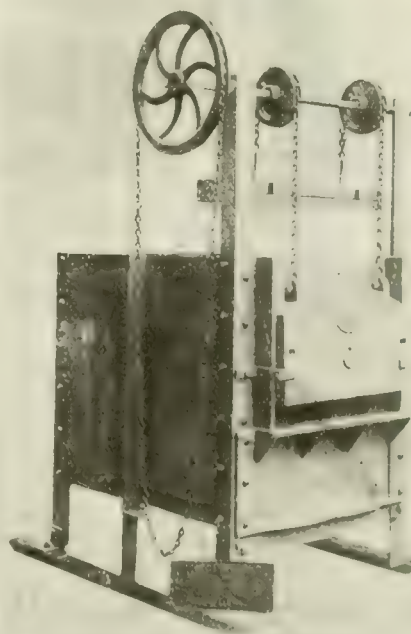
**OIL FURNACE**  
VERSUS  
**COAL FURNACE**

*Write To-day for Full Particulars.*

**Mechanical Engineering Company,**  
Limited

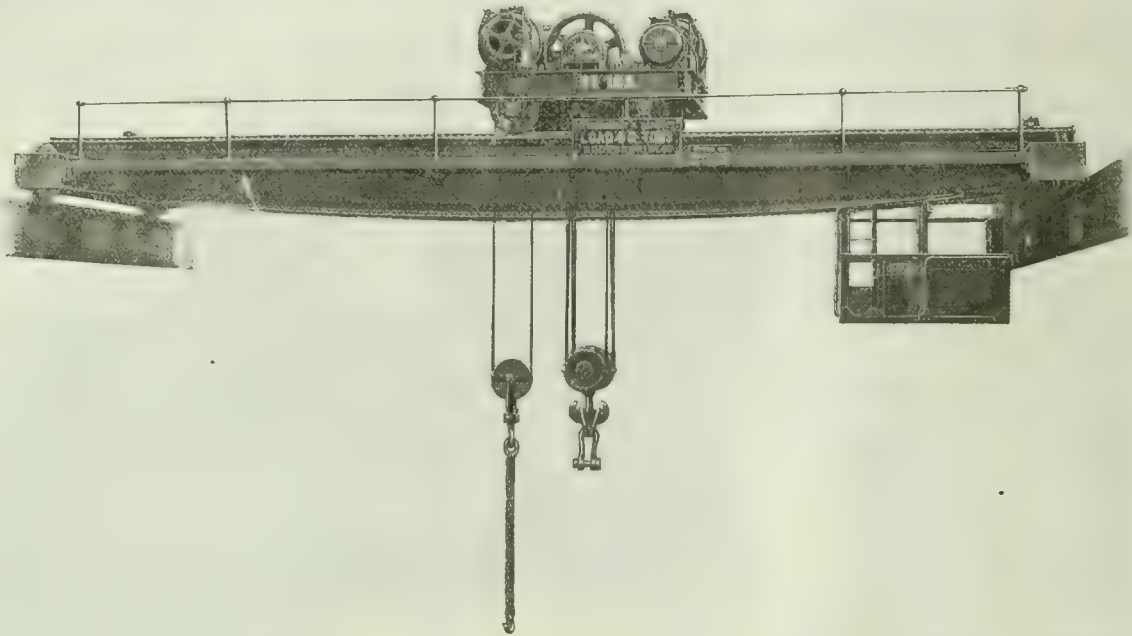
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There is unusual strength, accuracy, speed, convenience and range in

## AURORA Drilling Machines

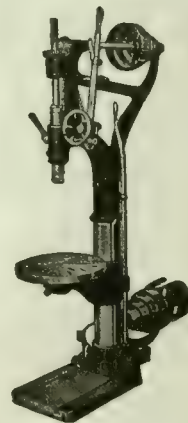
You can use them to great advantage on any work in your shop that's suitable for a machine tool of this kind. The operating is easy and the labor cost comparatively low.

Drop a line for full particulars and specifications.  
Stationary Head Sizes 20"—21"  
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**The Aurora Tool Works**  
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# BARNES



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Complete line. 8-inch to 50-inch swing  
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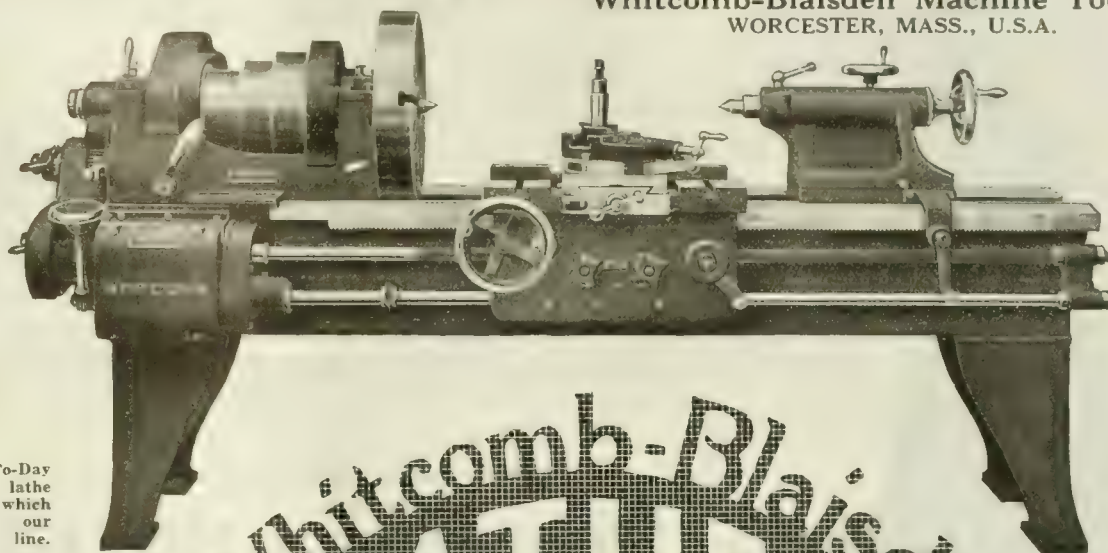
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## Adapted to all kinds of Rapid Manufacturing

WHETHER your lathe requirements must suit the rapid manufacture of intricate parts or versatile demands of modern tool room practice, one of the Whitcomb-Blaisdell Line will fit exactly your individual needs. When you buy a Whitcomb-Blaisdell Lathe you get a big measure of service in return for every dollar invested. The entire line of W-B Lathes is distinguished for superior design, workmanship and material. Rigid inspection and thorough working tests in our shops are your assurance of accuracy and dependability.

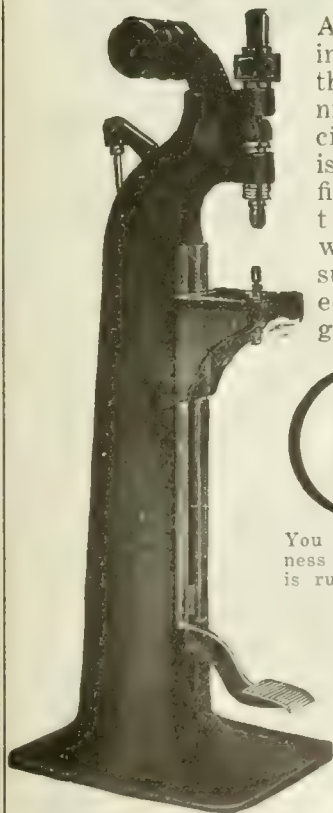
**Whitcomb-Blaisdell Machine Tool Co.**  
WORCESTER, MASS., U.S.A.



Write To-Day  
for our lathe  
Catalog which  
describes our  
complete line.

Whitcomb-Blaisdell  
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Anybody with ordinary intelligence can operate this Rotary Rivet Spinning Machine. No special skill is required. It is a tool that perfectly fits labor conditions as they exist to-day. A woman can operate as successfully as the skilled mechanic who has gone to the front.

The  
**GRANT**  
is Noiseless

You are assured of perfect quietness wherever the Grant Rotary is running. And it spins a perfect polished rivet head every second without breaking or marring the casting. Rivets tight or loose. Write for details.

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Mfg. & Machine Co.  
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He will make an expert survey of your production methods and show you where the trouble is and how to remedy it.

It's the Cheapest Way.  
Others are doing it.

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guarantees perfect work at less than half the ordinary expense.

Rotary, self-feeding shears designed for cutting in and out curves, straight or irregular shearing, circles, also beveling and splitting of plates. Built in various sizes having capacities from tin up to  $\frac{1}{2}$ " thick. No limit to the size of sheet being cut. Hand, belt or motor drives. The last word in metal cutting shears. We also manufacture Rotary Bevel Shears, Splitting Shears and Plate Milling Machines.

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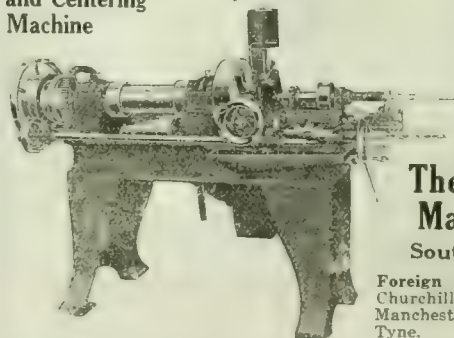
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Another Cuts Down  
and  
They Both Cut  
at Once

Hurlbut,  
Rogers  
Cutting-off  
and Centering  
Machine



## Here's Real Economy !

This patented Hurlbut Rogers Cutting-Off and Centering Machine embodies two cutting-off tools one cutting up and the other holding the work against the other. What is the result? the production is doubled and the cost is cut in half. Further, the centering operation goes on at the same time. Doesn't this appeal to you as real economy in production? When you are assured of such good-paying results why hesitate to adopt this machine? Seen pays for itself.

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Machine Company**  
South Sudbury Mass.

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# Wherever Pipe is Cut or Threaded Economically

The probability is two to one that it's a

## Williams Pipe Machine

that's on the job.

For in approximately two-thirds of all the larger plants in this country Williams' Pipe Machines are used.

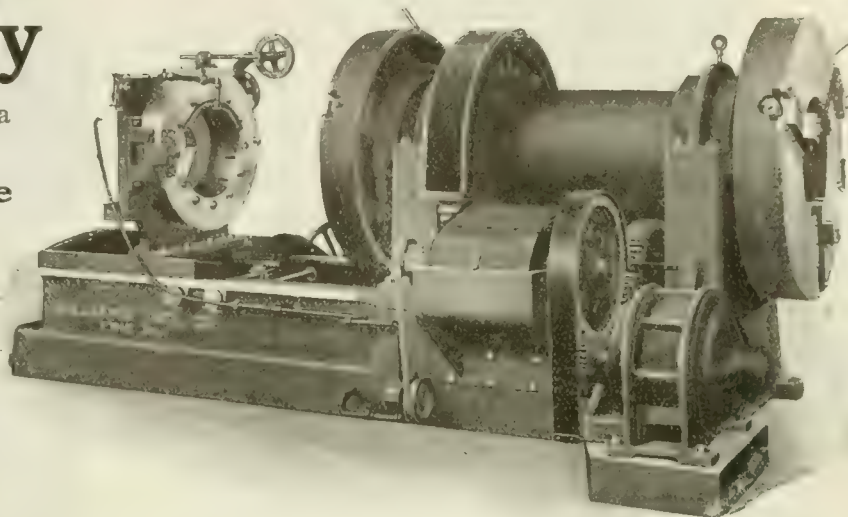
It was the Williams Pipe Machine that brought highest honors home from the Panama Exposition.

The Machine illustrated has a capacity of 21½" to 12". Also nine other sizes to meet your requirements.

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## Williams Tool Company

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# SIDNEY

## Heavy Duty Lathes

The 25-inch Heavy Duty Quick Change Sidney shown below is the last word in lathe construction. Every possible improvement will be found in this late model. Bed lengths available are 10, 12, 14, 16, 18 and 20 feet. Also built with a 27-inch swing.

### Easy Masters of Big Jobs

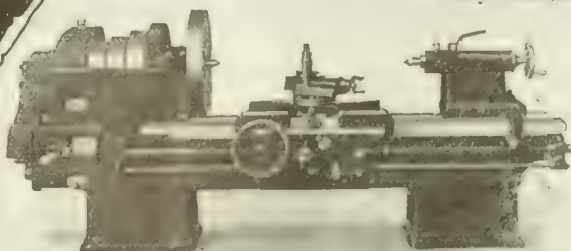
Regardless of the severity of work, dependence put on Sidney Lathes has never been misplaced. The Sidney line has made good with a vengeance. New Bulletin just issued on 25-inch machine. Write to day!

## The Sidney Tool Company

SIDNEY, OHIO

CANADIAN AGENTS:

The Geo. F. Foss Machinery & Supply Co., Montreal,  
Quebec. H. W. Petrie, Limited, Toronto, Ontario.





# Makes Every Machine Tool A Bigger, Better Producer

**N**O matter what the nature of the machine tool may be—Link-Belt Silent Chain Drives should increase its production and better its product.

The power is transmitted gently, yet positively. There is no slippage as with leather belts. And yet the sudden application of power on heavy cuts is thoroughly cushioned. For Link-Belt Silent Chain Drives are "flexible as a belt—positive as a gear—more efficient than either."

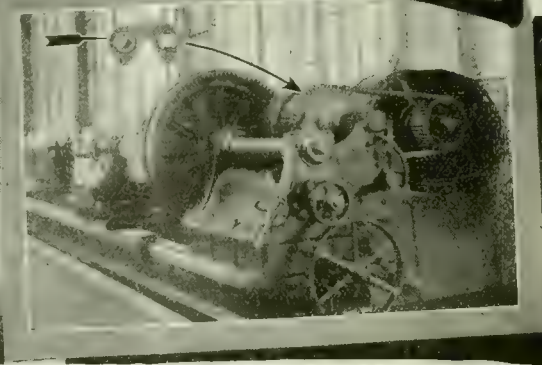
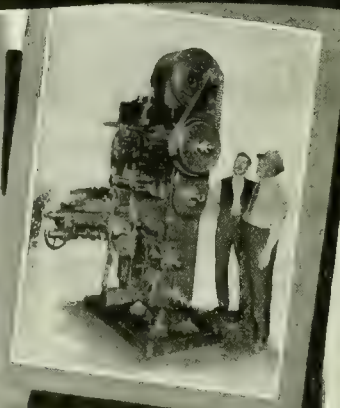
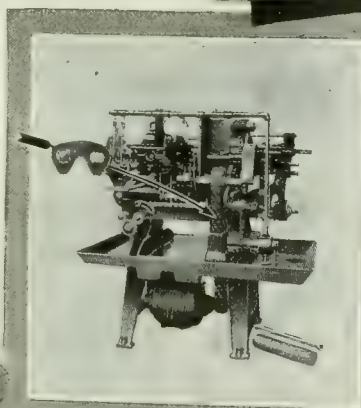
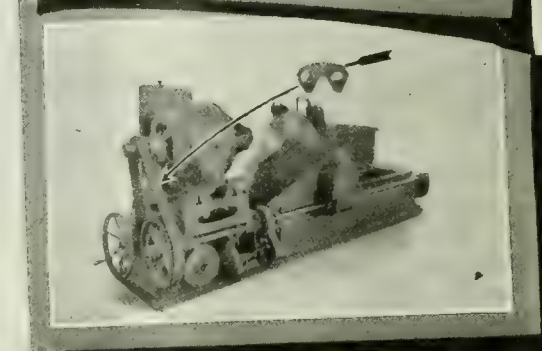
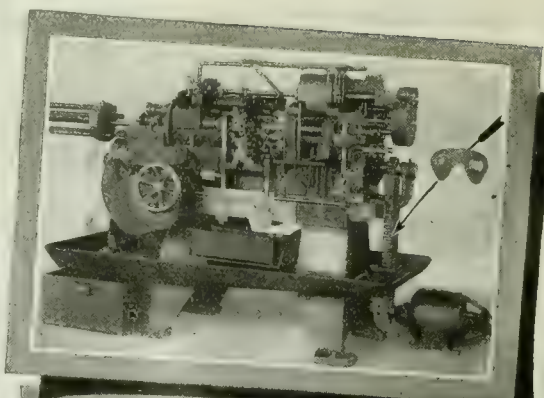
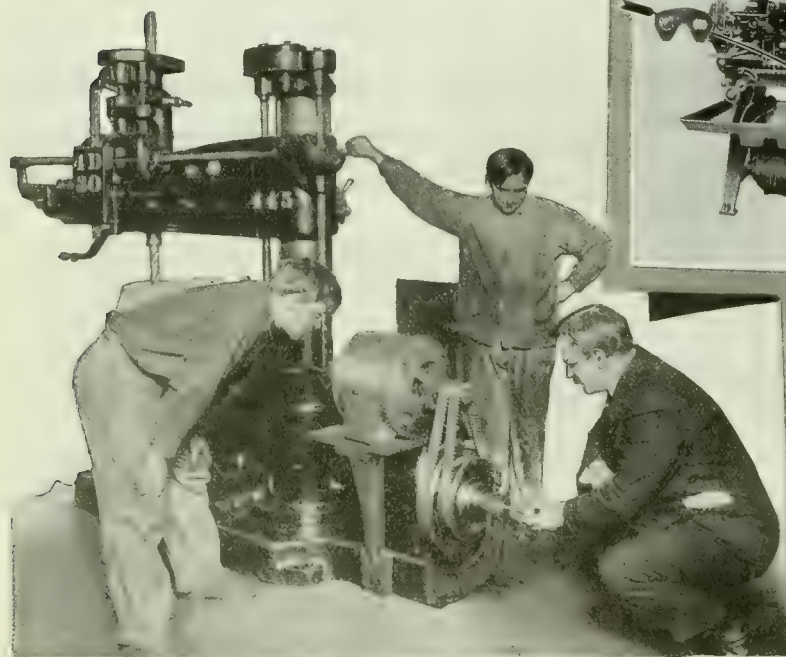
They permit short center drives, convenient location of driving parts and any speed reductions desired. They are 98.2% efficient—proven so by actual tests.

Our Machine Tool Book No. 312 gives details. Send for a copy.

200

**CANADIAN  
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LIMITED**

**Wellington and Peter Sts.  
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# LINK-BELT SILENT CHAIN DRIVES

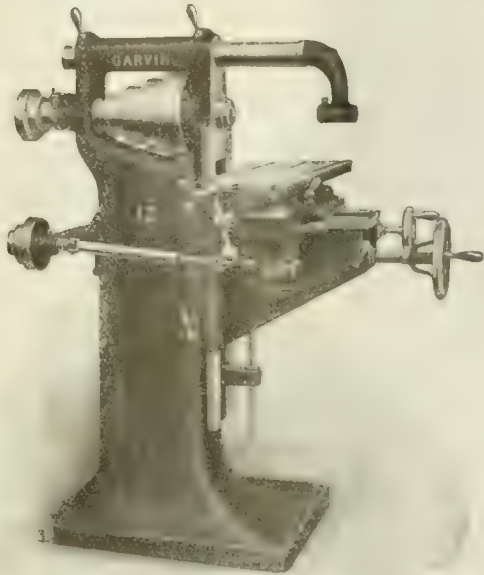
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No. 12 Plain Milling Machine—Use Code Abrade

## NO. 12 PLAIN MILLING MACHINE

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This machine is built especially strong and substantial for a tool of its capacity, and has many valuable features worthy of special mention. The slide is fitted with a quick pitch screw, giving one inch per turn. This combines the rigidity of a rack feed with the steadiness of the screw feed. The table has an oil pan all around it, with finished edges—automatic feed, trip and reverse—adjustable nut on the feed screw to take wear—the Feed Screw is hardened.

Adjustments .....18 x 6 x 15 in.

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Manufactured by

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50 Years New York City

# Chapman

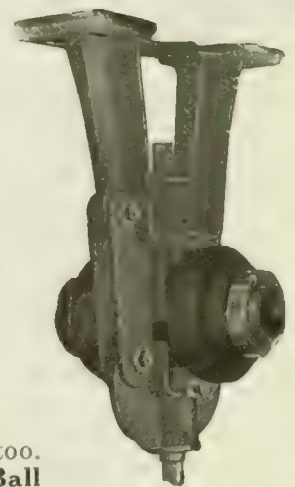
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**CONSERVE POWER!** There is too much power going to waste the world over. This fact has been noted by the British Government and sweeping reforms are contemplated in Great Britain.

Canada also wastes much power. A reform is necessary here, too. Babbitt bearings are being used too often where **Chapman Double Ball Bearings** should prevail. The adoption of Chapman Double Ball Bearings, wherever an axle or shafting needs support in the transmission of power, results in a saving of 75% of friction loss.

Now in use in over 2,000 Canadian factories. Fit any adjustable hanger. Adopted by Canadian and United States Governments.

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# Your Metal Cutting Problems Solved if you use the



MATERIAL TO BE CUT		NO. OF BLADE HAND FRAME		NO. OF BLADE POWER MACHINE			
		All Hard	Flexible or Soft Back	Light Machine	Medium Machine	Heavy Machine	Extra Heavy Machine
Light Angles		102	252	115	262		
Light Channels		103					
Light Tee Iron		112	250	115-B	255		
Light Ornamental		112-B		255	254	256	
Heavy Angles				255-B	254-B	256-B	
Channels				259			
Cast Iron				255-B	254-B	256-B	
Structural Steel				255-C	254-C	256-C	
Brass Pipe				255	254	256	
Tool Steel				252			
Sheet Metal				252			

## Cut Down Your Metal Cutting Cost

The Starrett Chart enables **you** to select the **proper** blade for **your** particular requirements, and was produced only after the most severe tests had been made on all classes of materials, being cut under various conditions.

Any one "Hack Saw" blade cannot be successfully used in cutting off Structural Steel, Iron or Brass Pipe, Cast Iron, Tool Steel or Sheet Metal. If that were practical, we would have made such a blade years ago.

### Increase the Efficiency of Your Cutting-Off Department

Your cutting costs will never be reduced until you select the proper blades for your particular requirements. The Starrett Chart 3 gives you that information and you can depend upon its reliability.

State your metal cutting problems to us, our service department will conclusively prove the above statements to you.

*Starrett Hack Saw Blades  
Manufactured by*

**The L. S. Starrett Company    Athol, Mass., U.S.A.**

*The World's Greatest Toolmakers  
Manufacturers of Hack Saws Unexcelled*

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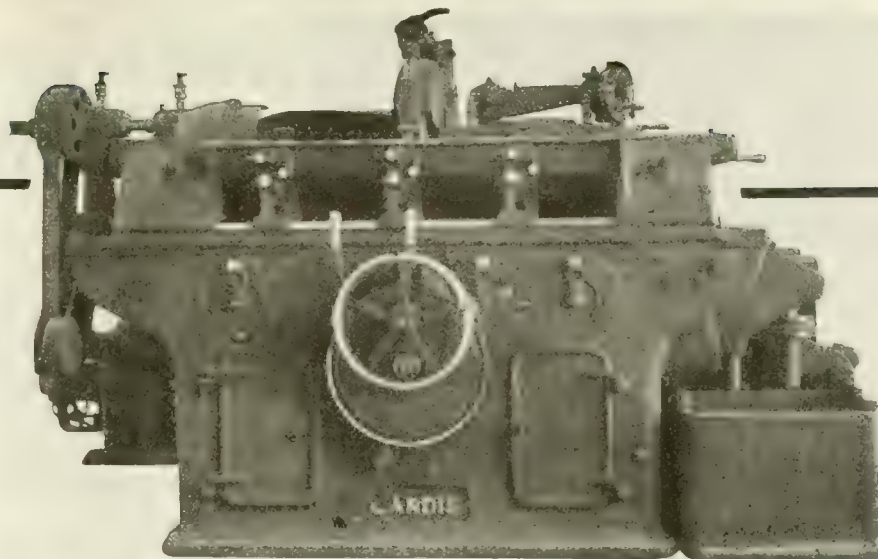
CHICAGO





**LANDIS**

Plain  
Self-contained  
Grinding  
Machine



## You Can't Afford to Overlook These LANDIS Features

**Work Table Stationary.** The Landis principle of having the work table stationary secures it firmly on the bed.

**Overhang Eliminated.** The Landis Grinding Wheel Head, in its travel, never goes beyond the length of the bed. The Landis Grinding Wheel Head is directly above the carriage and supported between the wide, well set apart, carriage ways.

**Downward Belt Pull.** The wide, powerful, endless grinding wheel belt pulls directly back and down from the wheel spindle, tending to secure the base with the bed.

Our catalog gives complete data and specifications of various types of Landis Grinding Machines.

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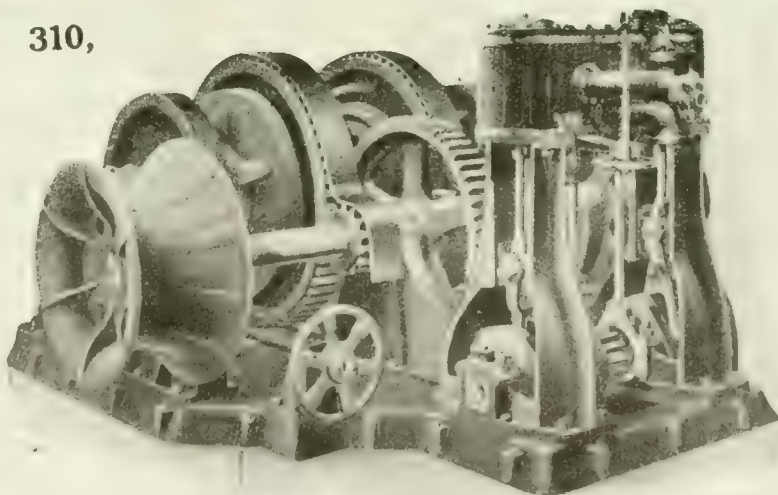
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Which have stood  
the test of  
50 YEARS



The "HYDE" Spur-Gear Steam Windlass

**Propeller  
Wheels**

*Largest Stock in  
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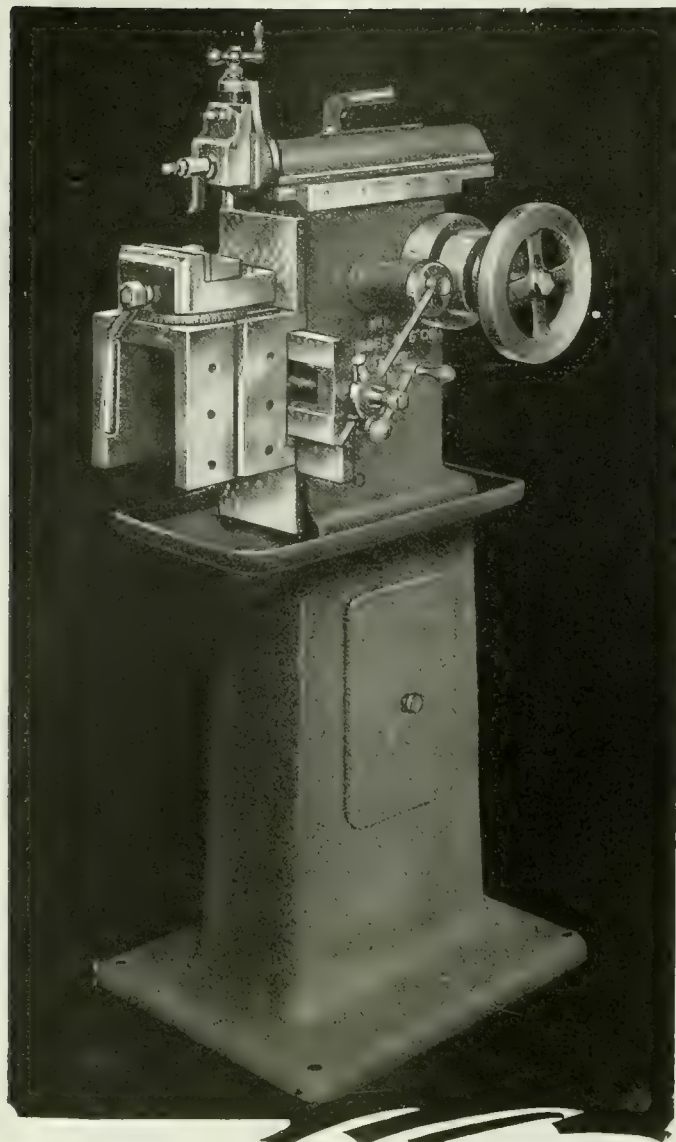
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Water Power  
Plant Machinery

**Steel  
Castings**

Manufactured by

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at Minimum Cost*

Don't do your shaping and slotting, tool-making, die-making, modeling and other classes of light work on big and expensively-operated machines when all this work can be done more accurately, quicker and cheaper by far, with the RHODES Machine. Being introduced all over the world on their cost-cutting merits.

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Tell them to turn them in when they have passed their "efficient point."

By doing so you will get more and better work from the men. You will save money because labor is more costly than material and your men will be better satisfied because no man likes to work with poor tools.

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GREAT WESTERN  
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Made in Canada by



**NICHOLSON FILE CO.**  
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Solving the "Impossible."  
Accuracy Almost Beyond Imagination.  
What is 0.00001"?  
Johansson Accuracy Once Doubted.  
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Treatment of the Steel.  
The Limit System.  
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Personal Equation.  
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Machinery, 1919

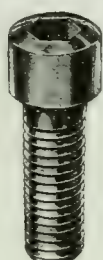
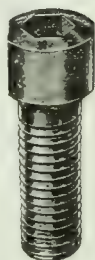


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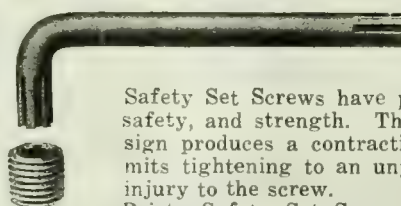
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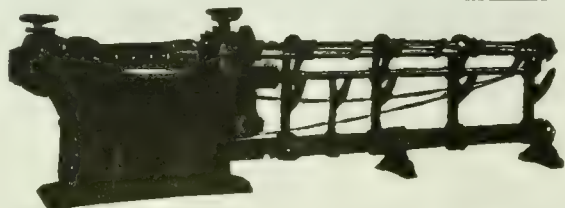


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**BRISTO**  
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Safety Set Screws have passed every test for safety, and strength. The patented fluted design produces a contracting effect which permits tightening to an unyielding grip without injury to the screw.

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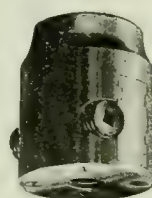
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Standard

DRILL CHUCKS Gearing Pattern  
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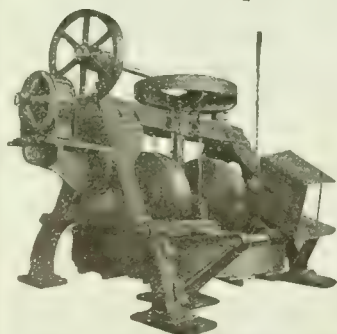


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NEW BRITAIN CONN., U.S.A.



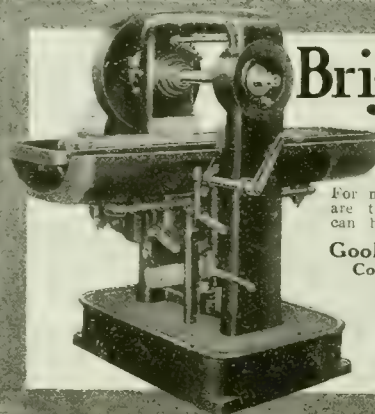
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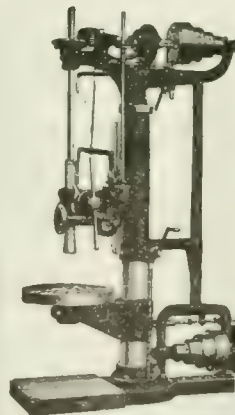
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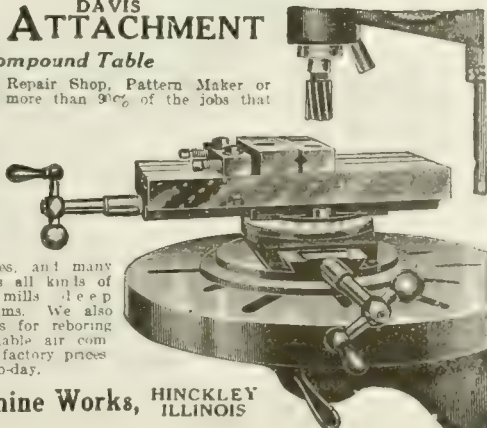
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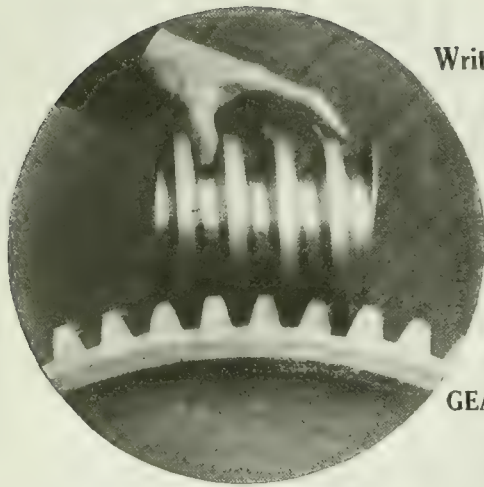
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"Type D" Electric Hoist

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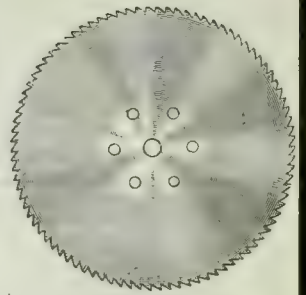
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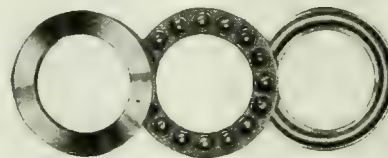
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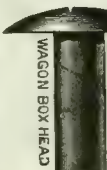
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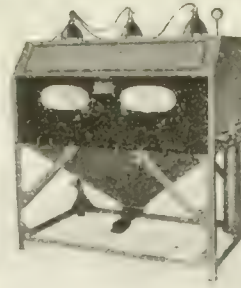
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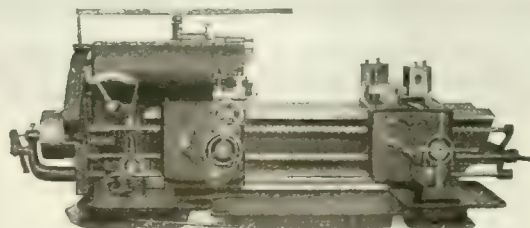


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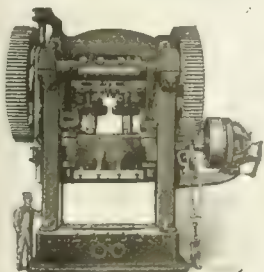
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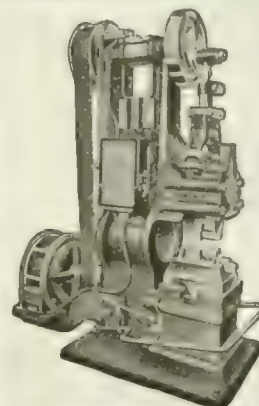
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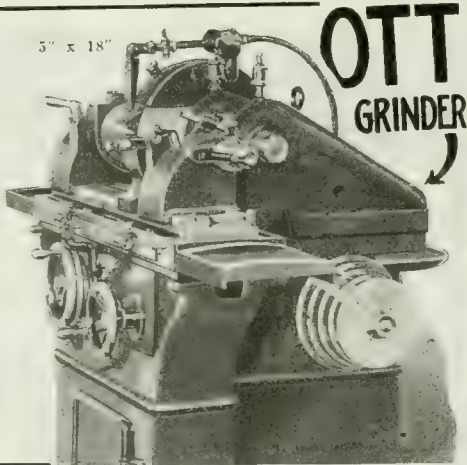


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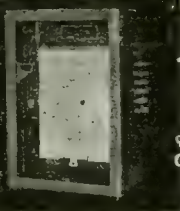
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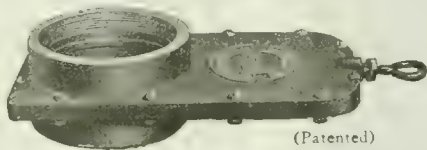
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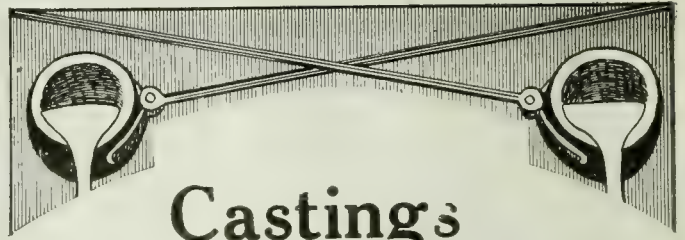
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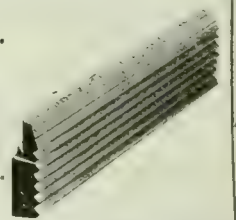
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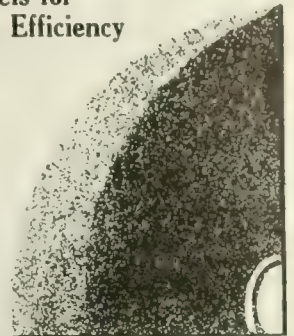
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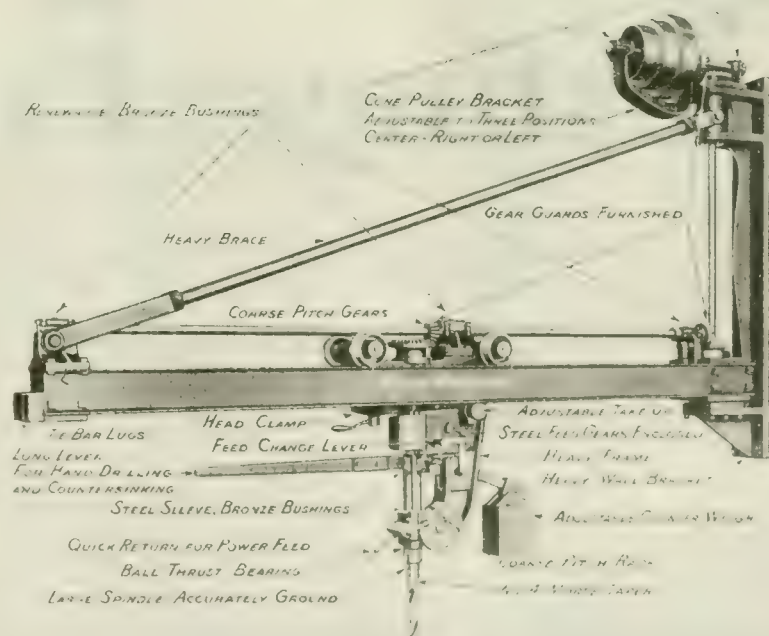
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Aikenhead Hardware Co., Toronto, Ont.

London Bolt & Hinge Works, London, Ont.

Rice, Lewis & Son, Toronto, Ont.

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

Steel Co. of Canada, Ltd., Hamilton, Ont.

United Brass & Lead Ltd., Toronto.

Wilkinson & Kompass, Hamilton, Ont.

Williams & Co., T. H., Brooklyn, N.Y.

## BOLTS, SPRING SHAKIE

Can. Winkley Co., Ltd., Windsor, Ont.

## BOLT AND NUT MACHINERY

Bertram & Sons Co., John, Dundas.

Canada Machinery Corp., Galt, Ont.

Garlock-Walker Machinery Co., Toronto, Ont.

Gardner & Son, Robt., Montreal.

Landis Machine Co., Waltham, Pa.

National Acme Co., Cleveland, Ohio.

National Machinery Co., Tiffin, Ohio.

Riverside Machinery Depot, Detroit, Mich.

Williams Machinery Co., A. R., Toronto.

Williams & Wilson, Ltd., Montreal, Que.



**BOLT THREADING MACHINERY**

Jardine & Co., Ltd., A. B. Hespeler, Ont.  
 Lewis Machine Co., Waynesboro, Pa.  
 National Acme Co., Cleveland, Ohio  
 Victor Tool Co., Waynesboro, Pa.  
 Williams & Wilson, Limited, Montreal, Que.

**BORING MACHINES, PNEUMATIC CYLINDER**

Cleveland Pneumatic Tool Co. of Canada, Toronto  
 Canadian Fairbanks-Morse Co., Montreal  
 Can. Ingersoll-Rand Co., Sherbrooke, Que.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
**BORING MACHINES, UPRIGHT AND HORIZONTAL**

Bertram & Sons Co., John, Dundas.  
 Betts Machine Co., Rochester, N.Y.  
 Canada Machinery Corp., Galt, Ont.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Siddings & Lewis Mfg. Co., Fond du Lac, Wis.  
 Gisholt Machine Co., Madison, Wis.  
 Lanous Tool Co., Waynesboro, Pa.  
 Niles-Bement-Pond Co., New York  
 Roelofson Machine & Tool Co., Toronto, Ont.  
 Williams & Wilson, Limited, Montreal, Que.

**BORING AND TURNING MILLS**

Bertram & Sons Co., John, Dundas.  
 Betts Machine Co., Rochester, N.Y.  
 Canada Machinery Corp., Galt, Ont.  
 Gisholt Machine Co., Madison, Wis.  
 Foss Mch. & Supply Co., The Geo. F., Montreal.  
 Niles-Bement-Pond Co., New York  
 Williams & Wilson, Limited, Montreal, Que.

**BOXES, STEEL SHOP AND TOTE**

Cleveland Wire Spring Co., Cleveland, Ohio.  
 New Britain Mach. Co., New Britain, Conn.

**BRAKEBAND LINING CUTTERS**

Peck, Stow & Wilcox Co., Southington, Conn.

**BRAKES**

Brown, Boggs & Co., Hamilton, Can.  
 Electric Steel & Metals, Ltd., Welland, Ont.

**BRASS AND COPPER BARS, RODS**

**BRASSES, CORNICE**  
 Peck, Stow & Wilcox Co., Southington, Conn.

**AND SHEETS**

Brown's Copper & Brass Rolling Mills, New Toronto.  
 Tallman Brass & Metal Co., Hamilton, Ont.

**BRASS FOUNDRERS**

Canada Metal Co., Toronto.  
 Greenleafs, Ltd., Belleville, Ont.  
 St. Lawrence Welding Co., Montreal, Que.  
 Tallman Brass & Metal Co., Hamilton, Ont.  
 United Brass & Lead Ltd., Toronto.  
 Wilson & Co., J. C., Belleville, Ont.

**BRASS WORKING MACHINERY**

Foster Machine Co., Elkhart, Ind.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Warner & Swasey Co., Cleveland, Ohio.  
 Niles-Bement-Pond Co., New York  
 Prest-O-Lite Co., Inc., Toronto, Ont.  
 Wood Turret Machine Co., Brazil, Ind.  
 Williams Mach. Co., A. R., Toronto.  
 Williams & Wilson, Ltd., Montreal, Que.

**BRICKS, FIRE**

Harbison-Walker Refractories Co. of Canada, Montreal, Que.

**BRIDGES, RAILWAY AND HIGHWAY**

Dominion Bridge Co., Montreal, Que.  
 MacKinnon Steel Co., Sherbrooke, Que.  
 Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

**BRONZE RODS AND SHEETS, PLATES**

Brown's Copper & Brass Rolling Mills, New Toronto.

**BRONZE, NAVAL**

Brown's Copper & Brass Rolling Mills, New Toronto.

**Canada Metal Co., Toronto.**

Tallman Brass and Metal Co., Hamilton, Ont.

**United Brass & Lead Ltd., Toronto.****BRONZE, COPPER****Canada Metal Co., Toronto.****BUFFING AND POLISHING MACHINERY**

Ford-Smith Mach. Co., Hamilton, Ont.  
 Foss Mch. & Supply Co., The Geo. F., Montreal.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 New Britain Machine Co., New Britain, Conn.  
 Williams & Wilson, Limited, Montreal, Que.

**BUCKETS, DUMP**

MacKinnon Steel Co., Sherbrooke, Que.  
 Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

**BUCKETS, ELEVATOR**

Can. Link-Belt Co., Toronto, Ont.  
 MacKinnon Steel Co., Sherbrooke, Que.

**BUCKETS, CLAM SHELL, CRAB, DUMP**

Can. Link-Belt Co., Toronto, Ont.  
 Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

**CHAINS, FOR ELEVATORS AND CONVEYORS**

Can. Link-Belt Co., Toronto, Ont.  
 Morse Chain Co., Ithaca, N.Y.  
 Williams & Wilson, Limited, Montreal, Que.

**CHAIN, MALLEABLE, DETACHABLE AND RIVETED**

Can. Link-Belt Co., Toronto, Ont.  
 Morse Chain Co., Ithaca, N.Y.

**CHAIN DRIVES**

Can. Link-Belt Co., Toronto, Ont.  
 Coventry Chain Co., Coventry, England.

**CHAINS, FOR ELEVATORS AND CONVEYORS**

Can. Link-Belt Co., Toronto, Ont.  
 Morse Chain Co., Ithaca, N.Y.

**CHASERS**

National Acme Co., Cleveland, Ohio.  
 Taylor J. A. M., 318 Stair Bldg., Toronto, Ont.

**CHEMISTS**

Toronto Testing Laboratory, Ltd., Toronto

**CHROME VANADIUM STEEL**

J. P. A. Comstedt, New York City, N.Y.  
 General Steel Co., Milwaukee, Wis.

**CHROME NICKEL STEEL**

J. P. A. Comstedt, New York City, N.Y.  
 General Steel Co., Milwaukee, Wis.

**CONDENSERS**

MacGovern & Co., Montreal, Que.  
 Smaller-General Co., Inc., Bay City, Mich.

**CARBONIZING BOXES**

Katie Foundry Galt, Ont.  
 Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.  
 Swedish Crucible Steel Co., Windsor, Ont.

**CARRIERS, PNEUMATIC TUBE**

Jones & Glasco, Montreal.

**CARS, INDUSTRIAL**

Can. Blower & Forge Co., Kitchener, Can.  
 Canadian Fairbanks-Morse Co., Ltd., Montreal  
 Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.  
 Sheldons, Limited, Galt, Ont.  
 Whiting Foundry Equipment Co., Harvey, Ill.

**CASTINGS, MACHINERY**

Winnipeg Iron Foundry Co., Winnipeg.  
 Wilson & Co., J. C., Belleville, Ont.

**CASTINGS, ALUMINUM, BRASS**

Algoma Steel Corp., Sault Ste. Marie, Ont.  
 Franklin Mfg. Co., Syracuse, N.Y.

**CASTINGS, DIE CAST**

Franklin Mfg. Co., Syracuse, N.Y.  
 Wentworth Mfg. Co., Hamilton, Ont.

**CARRIERS**

Alexander Fleck, Ltd., Ottawa.  
 Greenleafs, Ltd., Belleville, Ont.  
 Oberdorfer Brass Co., M. L., Syracuse, N.Y.  
 St. Lawrence Welding Co., Montreal, Que.  
 Tallman Brass & Metal Co., Hamilton.  
 United Brass & Lead Ltd., Toronto.

**CASTINGS, BRASS AND IRON**

Algoma Steel Corp., Sault Ste. Marie, Ont.

**CASTINGS, BUILDING**

Katie Foundry, Galt, Ont.

**CASTINGS, GRAY IRON**

Bernard Industrial Co., The A., Fortierville, Que.  
 Brown, Boggs & Co., Ltd., Hamilton, Can.

**CASTINGS, PLUMBERS'**

Alexander Fleck, Ltd., Ottawa.  
 Gardner & Son, Robt., Montreal.

**CASTINGS, NICHROME**

Can. Driver-Harris Co., Walkerville, Can.

**CASTINGS, HARDWARE**

Katie Foundry, Galt, Ont.

**CASTINGS, STEEL CHROME AND MANGANESE STEEL**

Thos. Davidson Mfg. Co., Montreal, Que.  
 Dominion Foundries & Steel, Ltd., Hamilton, Ont.

**CASTINGS, STEEL CHROME AND MANGANESE STEEL**

Hull Iron & Steel Foundries, Ltd., Hull, Que.  
 Kennedy & Sons, Ltd., Owen Sound.

**CASTINGS, MALLEABLE**

Fittings, Ltd., Oshawa, Ont.  
 International Malleable Iron Co., Guelph, Ont.

**CASTINGS, NICKEL STEEL**

Hull Iron & Steel Foundries, Ltd., Hull, Que.

**CEMENT MACHINERY**

Canadian Fairbanks-Morse Co., Ltd., Montreal.

**CEMENT HANDLING MACHINERY**

Can. Link-Belt Co., Toronto, Ont.

**CENTERING MACHINES**

Victoria Foundry Co., Ottawa, Ont.

**CENTRE REAMERS**

Bertram & Sons Co., John, Dundas.  
 Gardner, Robt., & Son, Montreal.

**CEMENT HANDLING MACHINERY**

Can. Link-Belt Co., Toronto, Ont.

**CENTERING MACHINES**

Victoria Foundry Co., Ottawa, Ont.

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**CENTRE REAMERS**

Bertram & Sons Co., John, Dundas.  
 Gardner, Robt., & Son, Montreal.

**CEMENT HANDLING MACHINERY**

Can. Link-Belt Co., Toronto, Ont.

**CENTERING MACHINES**

Victoria Foundry Co., Ottawa, Ont.

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Garvin Machine Co., New York.

**CHUCKS, COLLET, AIR**

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Smalley-General Co., Inc., Bay City, Mich.  
 Williams & Wilson, Limited, Montreal, Que.

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Aikenhead Hardware Co., Toronto, Ont.

Almond Mfg. Co., T. R., Ashburnham, Mass.  
 Bertram & Sons Co., John, Dundas.

Can. Blower & Forge Co., Kitchener, Canada  
 Canadian Fairbanks-Morse Co., Ltd., Montreal.

Gushman Chuck Co., Hartford, Conn.  
 Foss Mch. & Supply Co., The Geo. F., Montreal.

Gardner, Robt., & Son, Montreal.  
 Garlock-Walker Machinery Co., Toronto, Ont.

Gisholt Machine Co., Madison, Wis.  
 Hardinge Bros., Chicago, Ill.

Jacobs Mfg. Co., Hartford, Conn.  
 Ker & Goodwin, Brantford.

Knight Metal Products, Ltd., Toronto, Ont.  
 Modern Tool Co., Erie, Pa.

Rice, Lewis & Son, Toronto, Ont.  
 Skinner Chuck Co., New Britain, Conn.

Whiton Machine Co., D. E., New London, Conn.  
 Williams & Wilson, Limited, Montreal, Que.

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 Whitney Mfg. Co., Hartford, Conn.

**CHUCKS, FRICTION AND TAP**

Victor Tool Co., Waynesboro, Pa.

**CHUCKS, MAGNETIC**

Heald Machine Co., Worcester, Mass.

Williams & Wilson, Limited, Montreal, Que.

**CHUCKS, RING WHEEL**

Ford-Smith Mach. Co., Hamilton, Ont.

**CHUCKS, WRENCH**

Thomas Elevator Co., Chicago, Ill.

**CHUCKING MACHINES**

Garvin Machine Co., New York.

Gisholt Machine Co., Madison, Wis.

New Britain Machine Co., New Britain, Conn.

National Acme Co., Windsor, Vt.

Niles-Bement-Pond Co., New York.

Roelofson Machine & Tool Co., Toronto, Ont.

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Can. Link-Belt Co., Toronto, Ont.

Carlisle Johnson Mach. Co., Manchester, Conn.

Jones & Glasco, Montreal, Que.

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Williams & Wilson, Limited, Montreal, Que.

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Dominion Bridge Co., Montreal, Que.

Marsh Engineering Works, Ltd., Belleville, Ont.

MacKinnon & Co., Montreal, Que.

MacKinnon Steel Co., Sherbrooke, Que.

Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

Northern Crane Works, Ltd., Walkerville, Ont.

Whiting Foundry Equipment Co., Harvey, Ill.

Williams & Wilson, Limited, Montreal, Que.

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**COLLARS, SHAFTING**

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Williams & Co., J. H., Brooklyn, N.Y.

Williams & Wilson, Limited, Montreal, Que.

**COLLECTORS, PNEUMATIC**

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Sheldons, Limited, Galt, Ont.

J. C. Wilson & Co., Belleville, Ont.

**COLLETS**

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Hardinge Bros., Inc., Chicago, Ill.

Wilson & Co., J. C., Belleville, Ont.

**COMPOSITION INGOT**

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Canada Metal Co., Toronto, Ont.

United Brass & Lead Ltd., Toronto.

Lynd-Farguhar Co., Boston, Mass.

**COMBINED OPEN SIDE PLANNER-SHAPER**

Lynd-Farguhar Co., Boston, Mass.

**COMPRESSORS, AIR**

Can. Ingersoll-Rand Co., Sherbrooke, Que.

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Frederick Pneumatic Mach. Co., St. Louis, Mo.

Garlock-Walker Machinery Co., Toronto, Ont.



## Only a Drawing-in Bolt Required to Hold Arbors and Collets

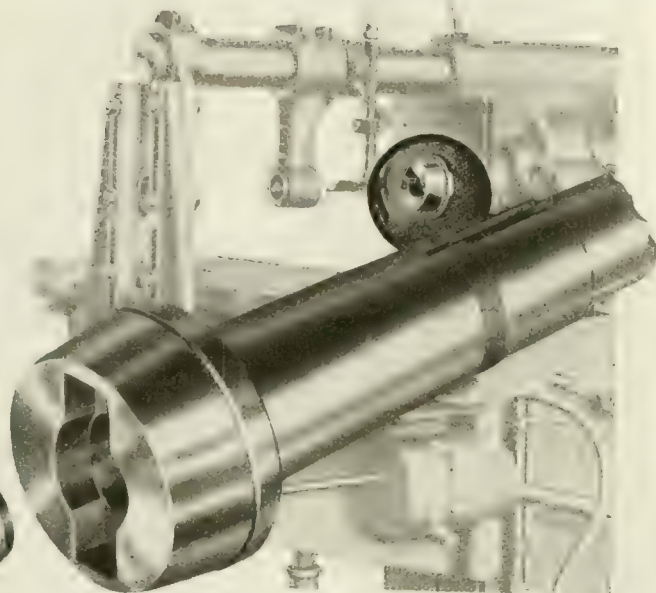
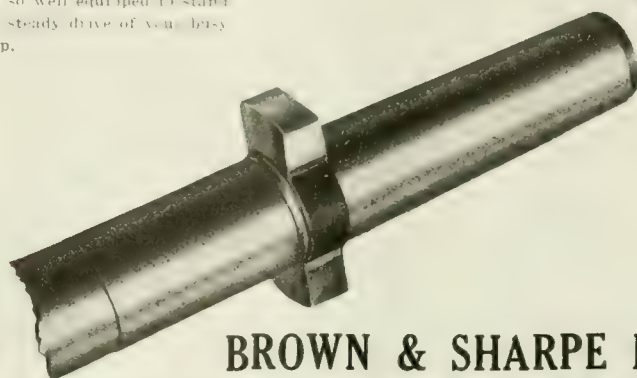
Clutch on arbor or collet fits recess in spindle and drawing-in bolt securely holds arbor or collet in place. This construction does away with plates, screws and loose parts; and as illustration shows

### No Drive Could be More Positive

The spindles of Brown & Sharpe Milling Machines are but one of the many features of these easy-to-operate, productive machines. Let us tell you about them in detail. See for yourself why they are so well equipped to stand the steady drive of your busy shop.

All Brown & Sharpe arbors have a shank as large in diameter as the largest standard arbor of the same taper.

*Nose of Spindle Free From Projecting Parts*



**Brown & Sharpe Mfg. Co.**  
PROVIDENCE, R.I., U.S.A.

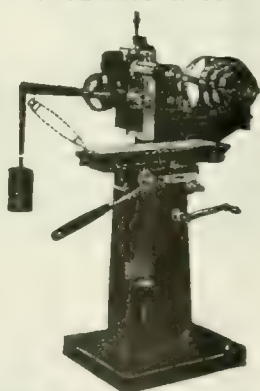
Canadian Representatives:

The Canadian Fairbanks-Morse Co., Ltd., Toronto, Montreal, Winnipeg, Calgary, Vancouver, St. John, Saskatoon.

**BROWN & SHARPE MILLING MACHINES**

## "Whitney" Hand Milling Machine

Thousands in Use



The Sliding Head makes the vertical feed independent of the horizontal feed. This feature permits the work to be held close to the table and enables the machine to be used for profiling. As the head is accurately counterbalanced, light milling may be done on long and heavy pieces without danger of breaking cutters.

The spindle is driven by interchangeable side pulleys giving six spindle speeds with three grade cone and four with two grade cone.

The Table has Hand Lever Feed, also Crank Feed operated by Rack and Pinion.

The Pinion Shaft is mounted in an eccentric bushing to allow for adjustment of pinion with rack.

The weight attachment feeds either head or table automatically and by varying the weights the pressure may be adjusted to a nicety.

Prompt deliveries

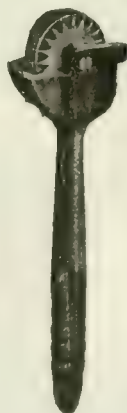
**The Whitney Mfg. Co. - Hartford, Conn.**

Chains Keys and Cutters Hand Milling Machines

## Every Emery Wheel With Its Own Dresser



Desirable, isn't it, now that cost is no objection? For with an inexpensive Desmond-Stephan Dresser for every wheel, every wheel will be touched up frequently and so kept true and equal to its original cutting efficiency.



For all ordinary shop grinding wheels specify "Diamo-Carbo"—the perfect diamond substitute.

For large, coarse, hard wheels ask for the "Desmond-Huntingdon."

Sherman Corrugated, 2 sizes  
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Magazine  
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The Desmond-Stephan complete line of Economical Grinding Wheel Dressers is catalogued. Write for copy.

**The Canadian Desmond-Stephan Mfg. Company**  
HAMILTON, ONTARIO

Alfred Herbert, Limited, Coventry, Agent for Great Britain



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Brown Engineering Corp., Toronto.  
Ford-Smith Machine Co., Hamilton, Ont.  
Homer & Wilson, Hamilton, Ont.  
Katie Foundry, Ltd., Galt, Ont.  
Marten Machine Co., Hamilton, Ont.  
St. Lawrence Welding Co., Montreal.  
Victoria Foundry Co., Ottawa.  
Wilson & Co., J. C., Belleville, Ont.  
Welland Motor & Machine Co., Welland, Ont.  
Windsor Mach. Tool Co., Windsor, Ont.

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**CONTROLLERS AND STARTERS**

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**CONTROLLING INSTRUMENTS**

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**CONVERTERS, ROTARY**

MacGovern & Co., Montreal, Que.

**CONVEYORS, BELT AND CHAIN**

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Jones & Glasco, Montreal.

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Bertram & Sons Co., John, Dundas, Ont.  
Garlock-Walker Machinery Co., Toronto, Ont.  
Niles-Bement-Pond Co., New York.  
Can. Blower & Forge Co., Kitchener, Ont.

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Cleveland Twist Drill Co., Cleveland.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
Pratt & Whitney Co., Dundas, Ont.  
Rice, Lewis & Son, Toronto, Ont.

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Almond Mfg. Co., T. R., Ashburnham, Mass.  
Baird Machine Co., Bridgeport, Conn.  
Ford-Smith Machine Co., Hamilton, Ont.  
Foster Machine Co., Elkhart, Ind.  
Williams & Wilson, Limited, Montreal, Que.

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Can. Link-Belt Co., Toronto, Ont.  
Williams & Wilson, Limited, Montreal, Que.

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Gardner, Robt., & Son, Montreal.  
Independent Pneumatic Tool Co., Chicago, Ill.  
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Northern Crane Works, Walkerville.

**CUPS, OIL**

Can. Winkley Co., Ltd., Windsor, Ont.

**COVERS, OIL HOLE**

Can. Winkley Co., Ltd., Windsor, Ont.

**CRANES, GANTRY**

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Northern Crane Works, Walkerville.

**CRANE RUNWAYS**

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**CRANES, GOLIATH, PNEUMATIC AND PORTABLE**

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Northern Crane Works, Walkerville.  
Wilson & Co., J. C., Belleville, Ont.  
Williams & Wilson, Limited, Montreal, Que.

**CRANES, TRAVELLING, ELECTRIC AND HAND POWER**

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Can. Link-Belt Co., Toronto, Ont.  
Curtis Pneumatic Machy. Co., St. Louis, Mo.  
Dominion Bridge Co., Montreal.  
Hepburn, John T., Ltd., Toronto, Ont.  
MacKinnon Steel Co., Sherbrooke, Quebec.  
Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.  
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.  
Niles-Bement-Pond Co., New York.  
Northern Crane Works, Walkerville.

**CRANK SHAFTS**

Canada Found's & Forgings, Ltd., Welland, Ont.  
Williams & Co., J. H., Brooklyn, N.Y.

**CRANES, PORTABLE**

Aikenhead Hardware Co., Toronto, Ont.  
Can. Link-Belt Co., Toronto, Ont.  
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.  
Northern Crane Works, Walkerville.  
Rice, Lewis & Son, Toronto, Ont.  
J. C. Wilson & Co., Belleville, Ont.  
Williams & Wilson, Limited, Montreal, Que.

**CRIMPS, LEATHER**

Graton & Knight Mfg. Co., Worcester, Mass.

**CRUSHED STEEL**

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

**CUPOLAS**

Can. Blower & Forge Co., Kitchener, Ont.  
Northern Crane Works, Walkerville.  
Sheldons, Ltd., Galt, Ont.

**CUPOLA BLAST GAUGES AND BLOWERS**

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**CURB PUMPS FOR OIL AND GASOLINE**

Ramser & Co., S. F., Inc., Fort Wayne, Ind.

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**CUT-OFF COUPLINGS, FRICTION**

J. C. Wilson & Co., Belleville, Ont.  
Williams & Wilson, Limited, Montreal, Que.

**CUTTERS, BOLT**

Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.  
Williams & Wilson, Limited, Montreal, Que.

**CUTTERS, FLUE**

Cleveland Pneumatic Tool Co. of Canada, Toronto.

**CUTTERS, PIPE (SEE PIPE CUTTERS)****CUTTERS, MILLING**

Becker Milling Machine Co., Boston, Mass.  
Boker & Co., Inc., H., Montreal, Que.  
Butterfield & Co., Rock Island, Que.  
Canadian Fairbanks-Morse Co., Ltd., Montreal.  
Cleveland Twist Drill Co., Cleveland.  
Davidson Tool Mfg. Co., New York, N.Y.  
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.  
Foss Mch. & Supply Co., The Geo. F., Montreal.  
Garvin Machine Co., New York.  
Illinois Tool Works, Chicago, Ill.  
Morse Twist Drill & Machine Co., New Bedford.  
Pratt & Whitney Co., Dundas, Ont.  
Rice, Lewis & Son, Toronto, Ont.  
Rabor Mfg. Co., Philadelphia, Pa.  
Whitney Mfg. Co., Hartford, Conn.

**CUTTING-OFF MACHINES**

Armstrong Bros. Tool Co., Chicago.  
Bertram & Sons Co., John, Dundas, Ont.  
Canadian Fairbanks-Morse Co., Ltd., Montreal.  
Curtis & Curtis Co., Bridgeport, Conn.  
Foss Mch. & Supply Co., The Geo. F., Montreal.  
Garlock-Walker Machinery Co., Toronto, Ont.  
Garvin Machine Co., New York.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Hurlburt, Rogers Machy Co., South Sundry, Mass.  
Hall & Sons, John H., Brantford, Ont.  
Kennedy & Sons, Wm., Owen Sound, Ont.  
Niles-Bement-Pond Co., New York, N.Y.  
Peerless Machine Co., Racine, Wis.  
Prest-O-Lite Co., Inc., Toronto, Ont.  
Racine Tool & Machine Co., Racine, Wis.  
Standard Mch. & Supplies, Ltd., Montreal, Que.  
Tabor Mfg. Co., Philadelphia, Pa.  
Wells Bros. of Can., Galt, Ont.  
Williams & Wilson, Limited, Montreal, Que.

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Elm Cutting Oil Co., Toronto.

Omario Lubricating Co., Hamilton, Ont.

**CUTTING OIL, RECLAIMING SYSTEM**

Bowser & Co., S. F., Inc., Fort Wayne, Ind.

**CUTTING AND WELDING PLANTS**

Prest-O-Lite Co., Inc., Toronto, Ont.

**CYANIDE AND LEAD BATH POTS**

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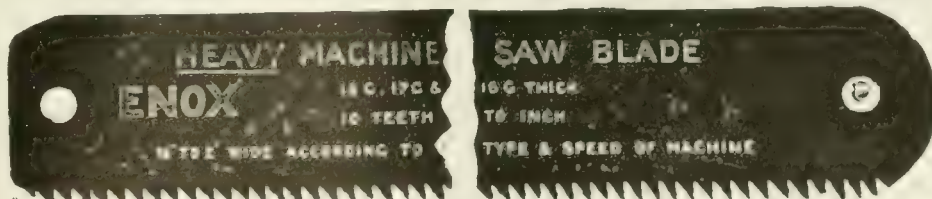
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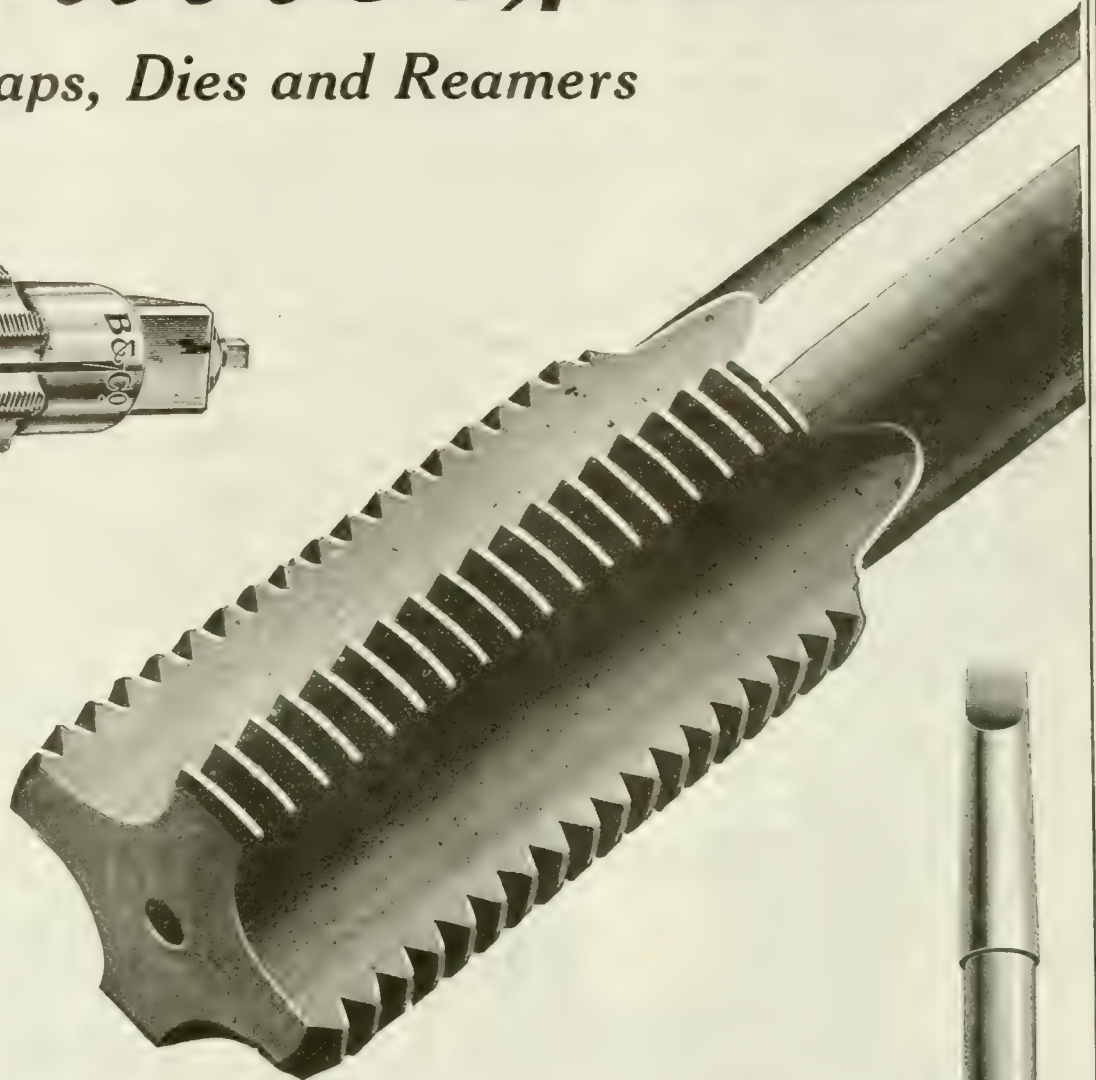
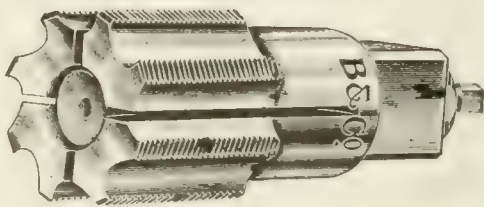
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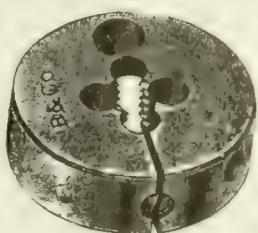
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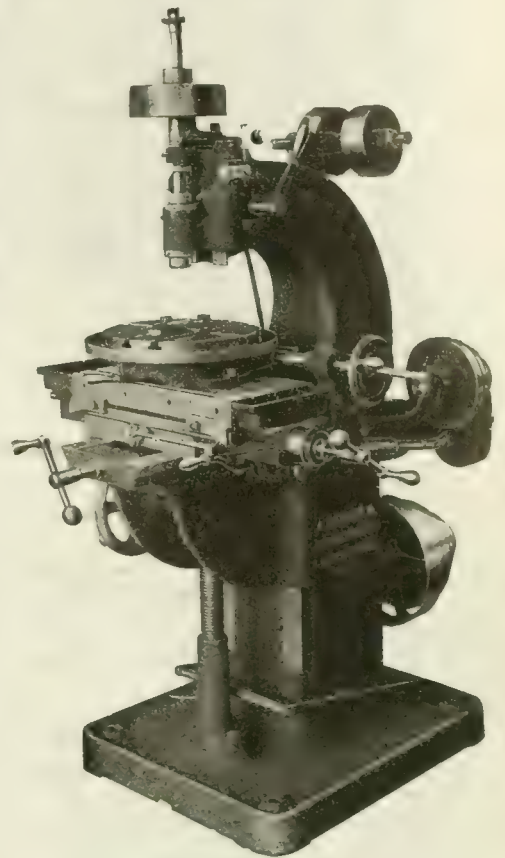
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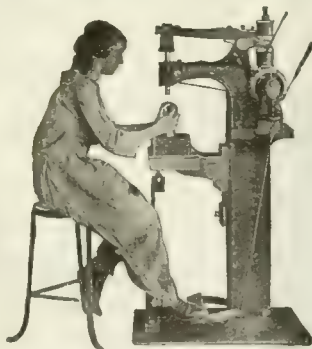
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A rivet in two seconds, size 1/4" to 3/8".

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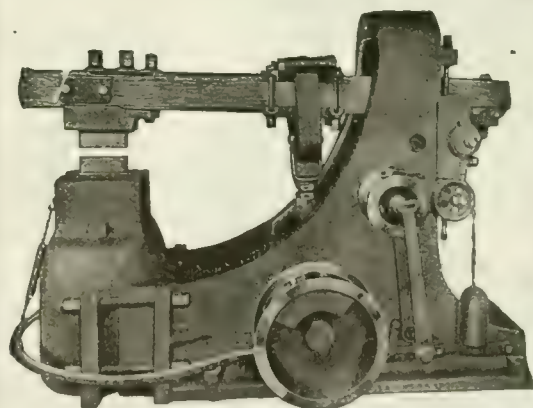
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United Brass & Lead Ltd., Toronto.

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**IRREGULAR CUTTING SHEARS**

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Northern Crane Works, Walkerville.  
Norton, A. O., Coaticook, Que.  
Rice, Lewis & Son, Toronto, Ont.  
Williams & Wilson, Limited, Montreal, Que.

**JACKS, PNEUMATIC**

Northern Crane Works, Walkerville.

**JACKS, PIT AND TRACK**

Canadian Fairbanks-Morse Co., Montreal.

**JAWS, FACE PLATE**

Gushman Chuck Co., Hartford, Conn.

**JIGS, TOOLS, ETC.**

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Elliott & Whitehall Mach. & Tool Co., Galt.  
Gisholt Machine Co., Madison, Wis.  
Homer & Wilson, Hamilton, Ont.  
Illinois Tool Works, Chicago, Ill.  
Marten Machine Co., Hamilton, Ont.  
Toronto Tool Co., Toronto, Ont.  
Normac Machine Co., St. Catharines, Ont.

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Garvin Machine Co., New York.  
Morton Mfg. Co., Muskegon Heights, Mich.  
A. R. Williams Machy. Co., Toronto.  
Williams & Wilson, Ltd., Montreal, Que.

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Williams & Co., J. H., Brooklyn, N.Y.

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Kennedy & Sons, Wm., Owen Sound, Ont.  
MacKinnon Steel Co., Sherbrooke, Que.  
Sheldons, Limited, Galt, Ont.

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AND TESTING (SEE CHEMISTS)

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Northern Crane Works, Walkerville.

**LAG SCREW GIMLET POINTERS**

National Machy. Co., Tiffin, Ohio.

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**LAMPS, TUNGSTEN**

Can. Laco-Phillips Co., Toronto, Ont.

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Wood Turret Machine Co., Brazil, Ind.  
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Curtis & Curtis Co., Bridgeport, Conn.  
Hendey Machine Co., Torrington, Conn.  
Williams & Co., J. H., Brooklyn, N.Y.

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Garlock-Walker Machinery Co., Toronto, Ont.  
Hardinge Bros., Chicago, Ill.  
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Pratt & Whitney Co., Dundas, Ont.  
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Hardinge Bros., Inc., Chicago, Ill.  
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**LATHES, ENGINE**

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John Bertram & Sons Co., Dundas.  
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Canada Machinery Corp., Galt, Ont.  
Canadian Fairbanks-Morse Co., Montreal.  
Cincinnati Lathe & Tool Co., Cincinnati, O.  
Cisco Machine Tool Co., Cincinnati, Ohio.  
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Garlock-Walker Machy. Co., Toronto, Ont.  
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Can. Fairbanks-Morse Co., Montreal.  
Garlock-Walker Machy. Co., Toronto, Ont.  
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Flessville Foundry, Flessville, Que.  
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Wood Turret Machine Co., Brazil, Ind.  
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Cisco Machine Tool Co., Cincinnati, Ohio.  
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Foster Machine Co., Elkhart, Ind.  
Garlock-Walker Machy. Co., Toronto, Ont.  
Hardinge Bros., Inc., Chicago, Ill.  
Wickes Bros., Saginaw, Mich.  
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Ford-Smith Machine Co., Hamilton, Ont.  
Foster Machine Co., Elkhart, Ind.  
Garlock-Walker Machy. Co., Toronto, Ont.  
Gisholt Machine Co., Madison, Wis.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Hardinge Bros., Inc., Chicago, Ill.  
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National Acme Co., Cleveland, Ohio.  
New Britain Machine Co., New Britain, Conn.  
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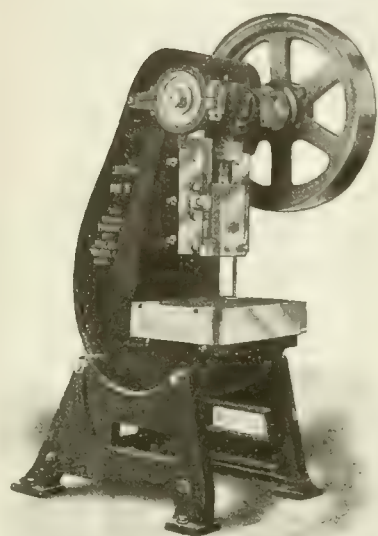
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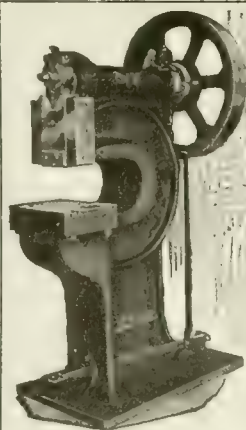


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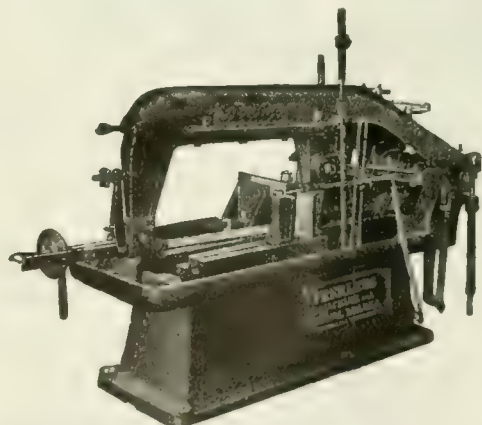
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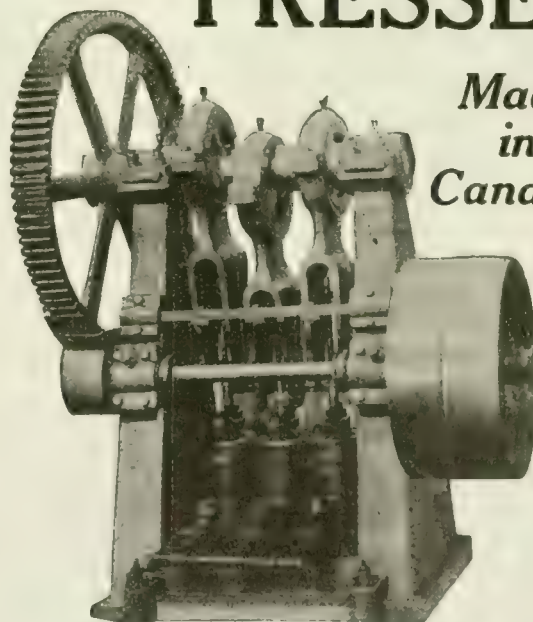
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Canada Machinery Corp., Galt, Ont.

Cincinnati Milling Machine Co., Cincinnati.

Ford-Smith Mach. Co., Hamilton, Ont.

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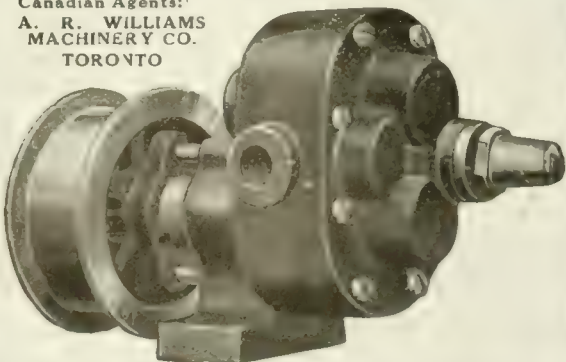
## ROTARY GEARED PUMPS

### Use the Individual Pump

Different classes of work require different compounds. By using the individual system, as many different compounds as desired may be used. This is a valuable feature. Trahern Rotary Geared Pumps. Would you like to try one? Write.

**Trahern Pump Company, Rockford, Ill.**

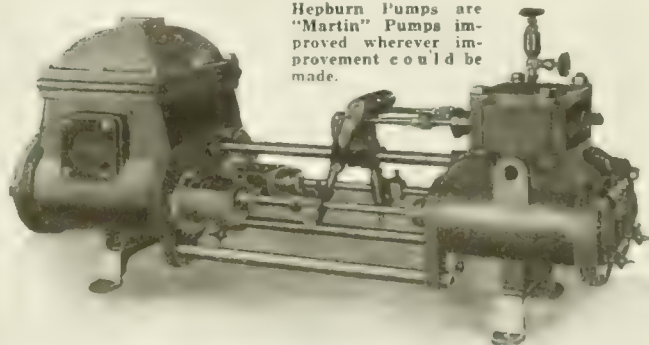
Canadian Agents:  
A. R. WILLIAMS  
MACHINERY CO.  
TORONTO



## Hepburn Pumping Machinery

Our line embraces standard duplex pumps for boiler feeding and for fire and general service; tank or low service duplex pumps; duplex hydraulic pumps for service in connection with hydraulic lifts and presses, accumulators and oil presses; pressure or mine pumps; horizontal power pumps and air and circulating pumps, etc.

Hepburn Pumps are  
"Martin" Pumps im-  
proved wherever im-  
provement could be  
made.



**JOHN T. HEPBURN, LIMITED**

18-60 Van Horne Street

Toronto, Ontario



**PATTERN SHOP EQUIPMENT**

Canada Machinery Corp., Galt, Ont.  
 Fox Machine Co., Jackson, Mich.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Williams & Wilson, Limited, Montreal, Que.

**PATENT SOLICITORS**

Budden, Hanbury A., Montreal.  
 Fetherstonhaugh & Co., Ottawa.  
 Marion & Marion, Montreal.  
 Radout & Maybee, Toronto.  
 Dominion Pattern Works, Toronto, Ont.  
 J. C. Wilson & Co., Belleville, Ont.  
 Greenleafs Ltd., Belleville, Ont.  
 Marten Machine Co., Hamilton, Ont.

**PECK CARRIERS FOR POWER PLANTS**

Can. Link-Belt Co., Toronto, Ont.  
**PERFORATED METALS AND ORNAMENTAL IRON GOODS**  
 Canada Wire & Iron Goods Co., Hamilton.

**PIG IRON**

Hanna & Co., M. A., Cleveland, O.  
 Steel Co. of Canada, Ltd., Hamilton, Ont.

**PIPE FITTINGS, MALLEABLE AND CAST IRON**

International Malleable Iron Co., Guelph, Ont.  
**PIPE CUTTING AND THREADING MACHINES**

Butterfield & Co., Rock Island, Que.  
 Can. Fairbanks-Morse Co., Montreal.  
 Curtis & Curtis Co., Bridgeport, Conn.  
 Fox Machine Co., Jackson, Mich.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Garvin Machine Co., New York.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 John H. Hall & Sons, Brantford.  
 A. B. Jardine & Co., Hespler, Ont.  
 Landis Machine Co., Waynesboro, Pa.  
 R. McDougall Co., Galt.  
 Wells Bros. Co. of Canada, Galt, Ont.  
 Williams Tool Co., Erie, Pa.  
 A. R. Williams Machy. Co., Toronto.  
 Williams & Wilson, Limited, Montreal, Que.

**PHOTOSTATS**

Commercial Camera Co., Providence, R.I.

**PIPE RIVETED STEEL**

Toronto Iron Works, Ltd., Toronto.

**PIPE CUTTERS, ROLLING**

Curtis & Curtis Co., Bridgeport, Conn.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 John H. Hall & Sons, Ltd., Brantford, Ont.  
 Wells Bros. Co. of Canada, Galt, Ont.

**PIPE TOOLS**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PIPE DIES**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PIPE CUTTERS**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PIPE REAMERS**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PIPE STOCKS**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PIPE THREADERS**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PIPE TAPS**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PIPE VISES**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PIPE WRENCHES**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.

**PISTON RODS, ROUGH TURNED**

General Steel Co., Milwaukee, Wis.

**PISTON AND PISTON RING MACHINES**

National Acme Co., Windsor, Vt.

**PLANER JACKS**

Armstrong Bros. Tool Co., Chicago.

**PLANERS, STANDARD AND ROTARY**

Betts Machine Co., Rochester, N.Y.  
 John Bertram & Sons Co., Dundas.  
 Canada Machinery Corp., Galt, Ont.  
 Can. Fairbanks-Morse Co., Montreal.  
 The Geo. F. Foss Mch. & Supply Co., Montreal.  
 Gardner, Robt., & Son, Montreal.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Garvin Machine Co., New York.  
 Hamilton Machine Tool Co., Hamilton, Ohio.  
 Morton Mfg. Co., Muskegon Heights, Mich.  
 Niles-Bement-Pond Co., New York.  
 Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.  
 Williams & Wilson, Limited, Montreal, Que.

**PLANING AND SHAPING MACHINERY**

Canada Machinery Corp., Galt, Ont.  
 Can. Fairbanks-Morse Co., Montreal.  
 The Geo. F. Foss Mch. & Supply Co., Montreal.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Garvin Machine Co., New York.  
 Hamilton Machine Tool Co., Hamilton, Ohio.  
 Niles-Bement-Pond Co., New York.  
 Steptoe, The John Co., Cincinnati, Ohio.  
 A. R. Williams Machy. Co., Toronto.  
 Williams & Wilson, Ltd., Montreal, Que.  
 Williams & Wilson, Limited, Montreal, Que.

**PLANER-SHAPER, COMBINED OPEN SIDE**

Lord-Farguhar Co., Boston.  
 Williams & Wilson, Limited, Montreal, Que.  
**POWER HAMMERS**  
 Quickwork Co., St. Marys, Ohio.  
**POWER TRANSMISSION MACHINERY**  
 Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.  
 Williams & Wilson, Limited, Montreal, Que.

**PLANING MILL EXHAUSTERS**

Can. Blower & Forge Co., Kitchener, Ont.  
 Sheldons, Ltd., Galt, Ont.  
 MacGovern & Co., Montreal, Que.  
 Niles-Bement-Pond Co., New York.

**POLE SAW FRAMES**

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

**PLIERS**

Aikenhead Hardware Co., Toronto.  
 Canadian Billings & Spencer, Ltd., Welland.  
 Peck, Stow & Wilcox Co., Southington, Conn.  
 Rice Lewis & Son, Toronto, Ont.

**POLE LINE HARDWARE**

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

**POWER CRANES, HAND**

MacKinnon Steel Co., Sherbrooke, Quebec.

**PLATE AND TANK CONSTRUCTION**

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

**POLISHING MACHINES**

Ford Smith Machine Co., Hamilton, Ont.  
 Williams & Wilson, Limited, Montreal, Que.

**POLISHING PLATES**

Greenfield Tap & Die Corp., Greenfield, Mass.  
 Wells Bros. of Can., Galt, Ont.  
 Williams & Wilson, Limited, Montreal, Que.

**POWER HOUSE CONVEYORS**

Can. Link-Belt Co., Toronto, Ont.  
 Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

**PRESSERS, ARBOR**

Atlas Press Co., Kalamazoo, Mich.  
 Metalwood Mfg. Co., Detroit, Mich.  
 Williams & Wilson, Limited, Montreal, Que.

**PRESSES, BROACHING, FORGING AND FLANGING**

Atlas Press Co., Kalamazoo, Mich.  
 E. W. Bliss Co., Brooklyn, N.Y.  
 Ferracute Machine Co., Bridgeton, N.J.  
 Metalwood Mfg. Co., Detroit, Mich.  
 Toledo Machine & Tool Co., Toledo.  
 Stoll Co., D. H., Buffalo, N.Y.  
 Williams & Wilson, Limited, Montreal, Que.

**PRESSES, CAM, TOGGLE, EYELET**

Baird Machine Co., Bridgeport, Conn.  
 Bliss Co., E. W., Brooklyn, N.Y.  
 Consolidated Press Co., Hastings, Mich.  
 Toledo Machine & Tool Co., Toledo.  
 Stoll Co., D. H., Buffalo, N.Y.  
 Williams & Wilson, Limited, Montreal, Que.

**PRESSES FOR SHELLS**

Atlas Press Co., Kalamazoo, Mich.  
 Bliss Co., E. W., Brooklyn, N.Y.  
 Ferracute Machine Co., Bridgeton, N.J.  
 The Geo. F. Foss Mch. & Supply Co., Montreal.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Hydraulic Machy. Co., Ltd., Montreal, Que.  
 Metalwood Mfg. Co., Detroit, Mich.  
 William R. Perrin, Ltd., Toronto.  
 Stoll Co., D. H., Buffalo, N.Y.  
 West Tire Setter Co., Rochester, N.Y.

**PRESSES, FILTER**

William R. Perrin, Ltd., Toronto.  
 Smalley-General Co., Inc., Bay City, Mich.

**PRESSES, PNEUMATIC**

Metalwood Mfg. Co., Detroit, Mich.  
 Toledo Machine & Tool Co., Toledo.

**PRESSES, DROP AND FORGING**

W. H. Banfield & Son, Toronto.  
 E. W. Bliss Co., Brooklyn, N.Y.  
 Brown, Boggs Co., Ltd., Hamilton, Canada.  
 Can. Fairbanks-Morse Co., Montreal.  
 Niles-Bement-Pond Co., New York.  
 William R. Perrin, Ltd., Toronto.  
 Stoll Co., D. H., Buffalo, N.Y.  
 Toledo Machine & Tool Co., Toledo.  
 Williams & Wilson, Limited, Montreal, Que.

**PRESSES, HYDRAULIC**

John Bertram & Sons Co., Dundas.  
 Metalwood Mfg. Co., Detroit, Mich.  
 Niles-Bement-Pond Co., New York.  
 William R. Perrin, Ltd., Toronto.  
 Toledo Machine & Tool Co., Toledo.  
 Stoll Co., Inc., D. H., Buffalo, N.Y.  
 West Tire Setter Co., Rochester, N.Y.  
 A. R. Williams Machy. Co., Toronto.  
 Williams & Wilson, Ltd., Montreal, Que.

**PRESSES, BALING**

William R. Perrin, Ltd., Toronto.

**PRESSES, POWER**

Baird Machine Co., Bridgeport, Conn.  
 E. W. Bliss Co., Brooklyn, N.Y.  
 Brown, Boggs Co., Ltd., Hamilton, Canada.  
 Canada Machinery Corp., Galt, Ont.  
 Can. Fairbanks-Morse Co., Montreal.  
 Consolidated Press Co., Hastings, Mich.  
 Ferracute Machine Co., Bridgeton, N.J.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Hydraulic Machy. Co., Ltd., Montreal, Que.  
 William R. Perrin, Ltd., Toronto.  
 Riverside Machinery Depot, Detroit, Mich.  
 Stoll Co., D. H., Buffalo, N.Y.  
 Toledo Machine & Tool Co., Toledo.  
 A. R. Williams Machy. Co., Toronto.  
 Williams & Wilson, Ltd., Montreal, Que.

**PRESSES, SPRING FOOT**

Bliss Co., E. W., Brooklyn, N.Y.  
 Brown, Boggs & Co., Hamilton, Ont.  
 Consolidated Press Co., Hastings, Mich.  
 Toledo Machine & Tool Co., Toledo.  
 Williams & Wilson, Limited, Montreal, Que.

**PRESSES, SCREW**

Barnes, W. F., & John Co., Rockford, Ill.  
 Bliss Co., E. W., Brooklyn, N.Y.  
 Ferracute Mach. Co., Bridgeton, N.J.  
 William R. Perrin, Ltd., Toronto.  
 Williams & Wilson, Limited, Montreal, Que.

**PRESSES, TRIMMING**

Bliss Co., E. W., Brooklyn, N.Y.  
 Canada Machinery Corp., Galt, Ont.  
 Consolidated Press Co., Hastings, Mich.

Erie Foundry Co., Erie, Pa.  
 Ferracute Mach. Co., Bridgeton, N.J.  
 Stoll Co., D. H., Buffalo, N.Y.  
 Williams & Wilson, limited, Montreal, Que.

**PRODUCTION WORK**

Windsor Mach. & Tool Co., Windsor, Ont.

**PROPELLERS**

Kennedy & Sons, Wm., Owen Sound, Ont.

**PSYCHROMETERS, SLING**

Taylor Instrument Co., Rochester, N.Y.

**PULLEYS**

Algoma Steel Corp., Sault Ste. Marie, Ont.  
 American Pulley Co., Philadelphia.  
 Baird Machine Co., Bridgeport, Conn.  
 Bernard Industrial Co., Fortierville, Que.  
 Brown & Sharpe Mfg. Co., Providence, R.I.  
 Can. Fairbanks-Morse Co., Montreal.  
 Ford-Smith Machine Co., Hamilton, Ont.  
 Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.  
 Positive Clutch & Pulley Works, Ltd., Toronto.  
 J. C. Wilson & Co., Belleville, Ont.  
 Standard Machy. & Supplies, Ltd., Montreal, Que.  
 A. R. Williams Machy. Co., Toronto.  
 Williams & Wilson, Ltd., Montreal, Que.

**PULLEYS, STEEL SASH, STEEL BELT**

American Pulley Co., Philadelphia, Pa.  
**PULLEYS, FRICTION CLUTCH**  
 American Pulley Co., Philadelphia.  
 Baird Machine Co., Bridgeport, Conn.  
 Bernard Industrial Co., A., Fortierville, Que.  
 Can. Link-Belt Co., Toronto, Ont.  
 Carlyle Johnson Machy. Co., Manchester, Conn.  
 Positive Clutch & Pulley Works, Ltd., Toronto.  
 Jones & Glasco, Montreal.  
 Johnson, Carlyle, Machy. Co., Manchester, Conn.  
 Williams & Wilson, Limited, Montreal, Que.

**PULLEYS, BELT**

American Pulley Co., Philadelphia, Pa.  
**PULP MILL MACHINERY**  
 Hydraulic Machy. Co., Ltd., Montreal, Que.  
 MacKinnon Steel Co., Sherbrooke, Que.

**PUMPS, CENTRIFUGAL**

Goldie & McCulloch Co., Galt, Ont.  
 Bowser & Co., Inc., S. F., Toronto, Ont.  
 Can. Blower & Forge Co., Kitchener, Ont.  
 Can. Ingersoll-Rand Co., Montreal, Que.  
 Darling Bros., Ltd., Montreal, Quebec.  
 M. L. Oberdorfer Brass Co., Syracuse, N.Y.  
 Pratt & Whitney Co., Dundas, Ont.  
 Sheldons, Ltd., Galt, Ont.  
 Williams & Wilson, Limited, Montreal, Que.

**PUMPS, FUEL OIL**

Bowser & Co., Inc., S. F., Toronto, Ont.  
 Darling Bros., Ltd., Montreal, Quebec.  
 Trahern Pump Co., Rockford, Ill.

**PUMPS, GEARED**

Darling Bros., Ltd., Montreal, Quebec.  
 M. L. Oberdorfer Brass Co., Syracuse, N.Y.

**PUMPS, HIGH PRESSURE**

William R. Perrin, Ltd., Toronto.

**PUMPS, ALL KINDS**

Darling Bros., Ltd., Montreal, Quebec.  
 M. L. Oberdorfer Brass Co., Syracuse, N.Y.  
 William R. Perrin, Ltd., Toronto.  
 A. R. Williams Machy. Co., Toronto.  
 Williams & Wilson, Ltd., Montreal, Que.

**PUMPS, HYDRAULIC**

Garlock-Walker Machinery Co., Toronto, Ont.  
 Darling Bros., Ltd., Montreal, Quebec.  
 Metalwood Mfg. Co., Detroit, Mich.  
 William R. Perrin, Ltd., Toronto.  
 Williams & Wilson, Limited, Montreal, Que.

**PUMPS, LUBRICATING, OIL STORAGE**

Bowser & Co., S. F., Inc., Fort Wayne, Ind.  
**PUMPS, HAND, FOR OIL AND GASOLINE**  
 Bowser & Co., S. F., Inc., Fort Wayne, Ind.

**PUMPS, RUBBER CEMENT**

Bowser & Co., S. F., Inc., Fort Wayne, Ind.

**PUMPS, POWER FOR OIL AND GASOLINE**

Bowser & Co., S. F., Inc., Fort Wayne, Ind.

**PUMPS, KEROSENE, OIL, SELF-MEASURING**

Bowser & Co., S. F., Inc., Fort Wayne, Ind.

**PUMPS, ROTARY, POWER DRIVEN**

Bowser & Co., Inc., S. F., Toronto, Ont.  
 Darling Bros., Ltd., Montreal, Quebec.  
 M. L. Oberdorfer Brass Co., Syracuse, N.Y.  
 Trahern Pump Co., Rockford, Ill.  
 Williams & Wilson, Limited, Montreal, Que.

**PUMPS, LUBRICANT, OIL, WATER**

Darling Bros., Ltd., Montreal, Quebec.  
 Fry's (London), Ltd., London, England.  
 M. L. Oberdorfer Brass Co., Syracuse, N.Y.  
 Trahern Pump Co., Rockford, Ill.

**PUMPS, MOTOR AND BELT DRIVEN**

Darling Bros., Ltd., Montreal, Quebec.  
 MacGovern & Co., Montreal, Que.  
 M. L. Oberdorfer Brass Co., Syracuse, N.Y.

**PUMPS, SUD**

Fry's (London), Ltd., London, England.

**PUMP LEATHERS**

Graton & Knight Mfg. Co., Worcester, Mass.

**PUNCHES AND DIES**

W. H. Banfield & Sons, Toronto.  
 E. W. Bliss Co., Brooklyn, N.Y.  
 Boker & Co., Inc., H., Montreal, Que.  
 Brown, Boggs Co., Ltd., Hamilton, Canada.  
 Can. Blower & Forge Co., Kitchener, Ont.  
 Ferracute Mach. Co., Bridgeton, N.J.  
 Can. Fairbanks-Morse Co., Montreal.  
 Gardner, Robt., & Son, Montreal.  
 A. B. Jardine & Co., Hespler, Ont.  
 Mulliner-Enlund Tool Co., Syracuse, N.Y.  
 Marten Machine Co., Hamilton, Ont.  
 Peck, Stow & Wilcox Co., Southington, Conn.  
 Pratt & Whitney Co., Dundas, Ont.  
 Stoll Co., D. H., Buffalo, N.Y.  
 Toledo Machine & Tool Co., Toledo, O.  
 Williams & Wilson, Limited, Montreal, Que.

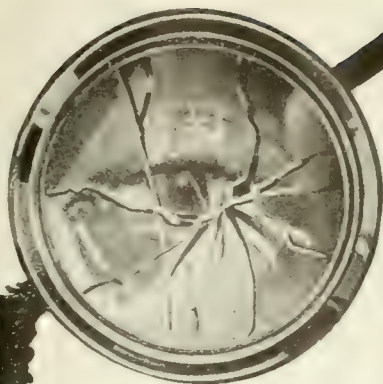
**PUNCHES, HAND**

Peck, Stow & Wilcox Co., Southington, Conn.

**PUNCHES, POWER**

John Bertram & Sons Co., Dundas, Ont.  
 E. W. Bliss Co., Brooklyn, N.Y.  
 Brown, Boggs Co., Ltd., Hamilton, Ont.





# STOCO

**EYE SAFE**

**"CELOGLAS"**  
**SHATTER-PROOF LENS**

## SAFETY GOGGLES

ANY glass goggle lens will break under a sufficiently hard blow. The wearer and his employer are primarily interested in what happens when the lens breaks—whether the splinters are driven into the eyes of the wearer or stay in the frame.

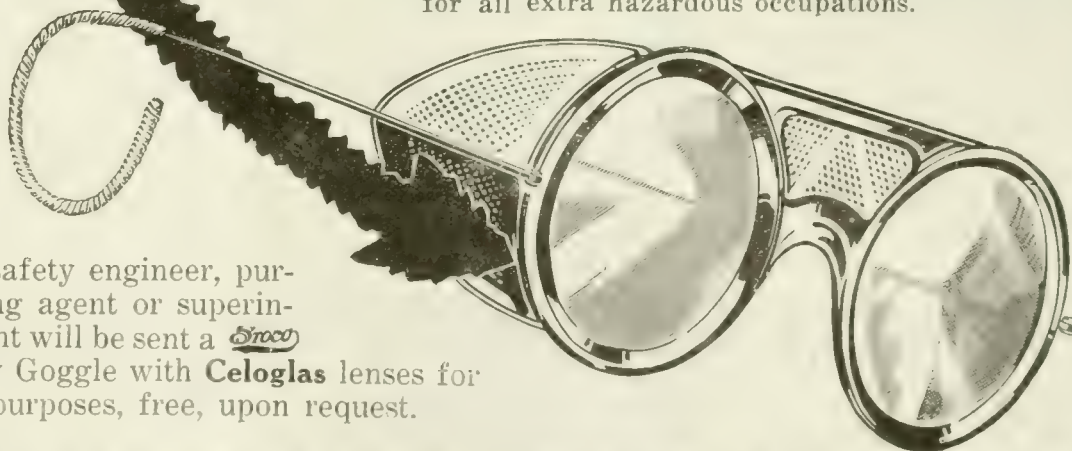
That's where the *Stoco* Celoglas shatter-proof lens saves the day. Even though it may be fractured by a flying missile, the lens will remain intact in the frame and no particles of glass can fly in the eyes.

*Stoco* Safety goggle frames with **Celoglas** lenses are the ideal eye protection. The *Stoco* frame is the strongest ever made for eye protection purposes. It protects around and **between** the eyes, and is so sturdily constructed that it will ward off any ordinary missile without inconvenience to the wearer. Light in weight and extremely comfortable in use. Lenses may be changed without the aid of special tools.

Made with easy cable ear-bows, as illustrated, or elastic headbands, at the same price.

Price with CELOGLAS shatter-proof lenses \$115.00 per hundred pairs  
Price with regular heavyweight glass lenses, \$90.00 per hundred pairs

*Stoco* Celoglas lenses are earnestly recommended for all extra hazardous occupations.



Any safety engineer, purchasing agent or superintendent will be sent a *Stoco* Safety Goggle with **Celoglas** lenses for trial purposes, free, upon request.

## STANDARD OPTICAL CO.

### GENEVA, N. Y.



Canada Machinery Corp., Galt, Ont.  
 Consolidated Press Co., Hastings, Mich.  
 Ferracute Mach. Co., Bridgeton, N.J.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 A. B. Jardine & Co., Limited, Hespeler, Ont.  
 Niles-Bement-Pond Co., New York.  
 Stoll Co., D. H., Buffalo, N.Y.  
 Wickes & Co., Saginaw, Mich.  
 Williams & Wilson, Limited, Montreal, Que.

**PUNCHES, CHROME, VANADIUM SHELL**  
 Hammond Steel Co., Inc., Syracuse, N.Y.

**PUNCHING MACHINES, HORIZONTAL**  
 Bertrams, Ltd., Edinburgh, Scotland.  
 Bertram & Sons Co., John, Dundas, Ont.  
 Canada Machinery Corp., Galt, Ont.  
 Wickes & Co., Saginaw, Mich.  
 E. W. Bliss Co., Brooklyn, N.Y.  
 Brown, Boggs Co., Ltd., Hamilton, Ont.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Niles-Bement-Pond Co., New York.  
 Williams & Wilson, Limited, Montreal, Que.

#### PIROMETERS

Bristol Co., Waterbury, Conn., U.S.A.  
 Shore Instrument & Mfg. Co., New York City.  
 Taylor Instrument Co., Rochester, N.Y.  
 Thwing Instrument Co., Philadelphia, Pa.

#### QUARTERING MACHINES

Bertram & Sons Co., John, Dundas, Ont.  
 Niles-Bement-Pond Co., New York.

#### RAILING, IRON AND BRASS

United Brass & Lead, Ltd., Toronto, Ont.

#### RAIL BENDERS

Algoma Steel Corp., Sault Ste. Marie, Ont.  
 Niles-Bement-Pond Co., New York.

#### RADIAL DRILLING MACHINE, WALL

Lynd-Farquhar Co., Boston.  
 Wickes & Co., Saginaw, Mich.

#### RAILROAD TOOLS

Can. Fairbanks-Morse Co., Montreal.  
 Garlock-Walker Machinery Co., Toronto, Ont.  
 Niles-Bement-Pond Co., New York.  
 Williams & Wilson, Limited, Montreal, Que.

#### RAIL OVERHEAD

Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

#### RAILWAY EQUIPMENT

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

#### RATCHETS

Keystone Mfg. Co., Buffalo, N.Y.

#### RAW HIDE PINIONS (SEE GEARS)

#### REAMERS, ADJUSTABLE

Can. Fairbanks-Morse Co., Montreal.  
 Cleveland Twist Drill Co., Cleveland.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Plewes, Ltd., Winnipeg, Man.  
 Pratt & Whitney Co., Dundas, Ont.  
 Standard Machy. & Supplies, Ltd., Montreal, Que.  
 The McCrosky Reamer Co., Meadville, Pa.  
 The Kelly Reamer Co., Cleveland, O.  
 Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.  
 Wells Bros. of Can., Galt, Ont.  
 Whitman & Barnes Mfg. Co., St. Catharines, Ont.  
 Wilt Twist Drill Co., Walkerville, Ont.

#### REAMERS, PIPE, CYLINDER

#### AND LOCOMOTIVE

Butterfield & Co., Rock Island, Que.  
 Can. Fairbanks-Morse Co., Montreal.  
 Cleveland Twist Drill Co., Cleveland.  
 Kelly Reamer Co., Cleveland, O.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Pratt & Whitney Co., Dundas, Ont.

#### REAMERS, BRIDGE, EXPANDING

#### AND HIGH SPEED

Aikenhead Hardware Co., Toronto.  
 Baxter & Co., Ltd., J. R., Montreal, Que.  
 Boker & Co., Inc., H., Montreal, Que.  
 Butterfield & Co., Rock Island, Que.  
 Can. Fairbanks-Morse Co., Montreal.  
 The McCrosky Reamer Co., Meadville, Pa.  
 Cleveland Twist Drill Co., Cleveland.  
 Gisholt Machine Co., Madison, Wis.  
 Illinois Tool Works, Chicago, Ill.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Pratt & Whitney Co., Dundas, Ont.

#### REAMERS, STEEL TAPER

#### AND SELF-FEEDING

Butterfield & Co., Rock Island, Que.  
 Can. Fairbanks-Morse Co., Montreal.  
 Cleveland Twist Drill Co., Cleveland.  
 Illinois Tool Works, Chicago, Ill.  
 A. B. Jardine & Co., Hespeler, Ont.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Pratt & Whitney Co., Dundas, Ont.

#### REAMERS, ROILER

Greenfield Tap & Die Corp., Greenfield, Mass.

#### REAMERS, CHUCKING

Greenfield Tap & Die Corp., Greenfield, Mass.

#### REAMERS, HAND

Greenfield Tap & Die Corp., Greenfield, Mass.

#### REAMERS, EXPANDING

Greenfield Tap & Die Corp., Greenfield, Mass.

#### REAMERS, PIN

Greenfield Tap & Die Corp., Greenfield, Mass.

#### REAMER FLUTING MACHINES

Garvin Machine Co., New York.

#### REAMERS, TAPER, BRIDGE

Greenfield Tap & Die Corp., Greenfield, Mass.

#### REAMERS, PIPE, SHELL

Greenfield Tap & Die Corp., Greenfield, Mass.

#### REAMING MACHINES, PNEUMATIC

Cleveland Pneumatic Co. of Canada, Toronto.

Garlock-Walker Machinery Co., Toronto, Ont.

#### RECORDING INSTRUMENTS

Bristol Co., Waterbury, Conn.

Gisholt Machine Co., Madison, Wis.

Taylor Instrument Co., Rochester, N.Y.

#### REELS, WIRE AND TEXTILE MFG.

American Pulley Co., Philadelphia, Pa.

#### REGULATORS, AUTOMATIC

Electric Steels & Metals, Ltd., Welland, Ont.

#### REGULATORS, PRESSURE

#### TEMPERATURE

Can. Fairbanks-Morse Co., Montreal.

Taylor Instrument Co., Rochester, N.Y.

#### RESPIRATORS

Strong, Kennard & Nutt Co., Cleveland, Ohio.

#### RIVETS, TUBULAR, BIFURCATED

Parmenter & Bulloch Co., Gananoque.

Rice Lewis & Son, Toronto, Ont.

Steel Co. of Canada, Ltd., Hamilton, Ont.

#### RIVETS, IRON, COPPER AND BRASS

Aikenhead Hardware Co., Toronto, Ont.

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

Parmenter & Bulloch Co., Gananoque.

Rice, Lewis & Son, Toronto, Ont.

Steel Co. of Canada Ltd., Hamilton, Ont.

#### RIVETERS, PNEUMATIC, HYDRAULIC,

#### HAMMER, COMPRESSION

Can. Fairbanks-Morse Co., Montreal.

Can. Ingersoll-Rand Co., Montreal.

Cleveland Pneumatic Tool Co. of Canada, Toronto.

Garlock-Walker Machinery Co., Toronto, Ont.

Independent Pneumatic Tool Co., Chicago, Ill.

Niles-Bement-Pond Co., New York.

#### RIVETING MACHINES, ELASTIC

#### ROTARY BLOW

Grant Mfg. & Machine Co., Bridgeport, Conn.

High-Speed Hammer Co., Rochester, N.Y.

Williams & Wilson, Limited, Montreal, Que.

F. B. Shuster Co., New Haven, Conn.

#### ROAD BUILDING EQUIPMENT

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

#### RODS

General Steel Co., Milwaukee.

Page Steel & Wire Co., Adrian, Mich.

#### ROLLER CHAINS

Can. Link-Belt Co., Toronto, Ont.

Jones & Glasco, Montreal.

#### ROLLS, BENDING AND STRAIGHTENING

John Bertram & Sons Co., Dundas.

Brown, Boggs Co., Ltd., Hamilton, Canada.

Canada Machinery Corp., Galt, Ont.

Garlock-Walker Machinery Co., Toronto, Ont.

Niles-Bement-Pond Co., New York.

Toledo Machine & Tool Co., Toledo, O.

Williams & Wilson, Limited, Montreal, Que.

#### ROOF COOLERS

Electric Steels & Metals, Ltd., Welland, Ont.

#### ROLLS, CRUSHING

Can. Link-Belt Co., Toronto.

#### RUBBER MILL DRIVES

Can. Link-Belt Co., Toronto, Ont.

#### RUBBER MILL MACHINERY

Bertrams, Ltd., Edinburgh, Scotland.

#### RULES

Brown & Sharpe Mfg. Co., Providence.

James Chesterman & Co., Ltd., Sheffield, Eng.

Rice Lewis & Son, Toronto, Ont.

L. S. Starrett Co., Athol, Mass.

#### RULES, STEEL, STRAIGHT AND FOLDING

Lufkin Rule Co. of Can., Windsor, Ont.

#### RULES, BOXWOOD, FOLDING

Lufkin Rule Co. of Can., Windsor, Ont.

#### RULES, BOARD AND LONG

Lufkin Rule Co. of Can., Windsor, Ont.

#### SAW MILL CONVEYORS

Can. Link-Belt Co., Toronto, Ont.

Williams & Wilson, Limited, Montreal, Que.

#### SAND MILLS

Frost Mfg. Co., Chicago, Ill.

#### SAND-BLAST EQUIPMENT

Pangborn Corporation, Hagerstown, Md.

#### SAND BLAST MACHINES

Pangborn Corporation, Hagerstown, Md.

#### SAND BLAST SUPPLIES AND ACCESSORIES

Pangborn Corporation, Hagerstown, Md.

#### SAFETY APPLIANCES

Strong, Kennard & Nutt Co., Cleveland, Ohio.

#### SAFETY APPLIANCE GOGGLES

Wilson Co., Inc., T. A., Reading, Pa.

#### SAND BLAST ABRASIVES

Pangborn Corporation, Hagerstown, Md.

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

#### SAND MIXING MACHINERY

Frost Mfg. Co., Chicago, Ill.

#### SANDING MACHINES

Canada Machinery Corp., Galt, Ont.

#### SAW MILL MACHINERY

Can. Fairbanks-Morse Co., Montreal.

Canada Machinery Corp., Galt, Ont.

Gardner, Robt., & Son, Montreal.

Curtis Pneumatic Machy. Co., St. Louis, Mo.

A. R. Williams Machy. Co., Toronto.

Williams & Wilson, Ltd., Montreal, Que.

#### SASH WEIGHTS AND WRENCHES

Fittings, Ltd., Oshawa, Ont.

#### SAWS, CIRCULAR METAL

Plewes, Ltd., Winnipeg, Man.

Simonds Mfg. Co., Fitchburg, Mass.

Tabor Mfg. Co., Philadelphia, Pa.

#### SAWS, HACK (SEE HACK SAWS)

Hunter Saw & Mach. Co., Pittsburgh, Pa.

Tabor Mfg. Co., Philadelphia, Pa.

#### SAW SHARPENERS

Greenfield Tap & Die Corp., Greenfield, Mass.

Wells Bros. of Can., Galt, Ont.

#### SAWS, SLITTING

Taylor, J. A. M., Stair Bldg., Toronto, Ont.

#### SCALES, MECHANICAL

Lufkin Rule Co. of Can., Windsor, Ont.

#### SCLEROSCOPES

Shore Instrument & Mfg. Co., New York City.

#### SCREENING MACHINERY

Can. Link-Belt Co., Toronto, Ont.

#### SCREW EXTRACTORS

Cleveland Twist Drill Co., Cleveland, O.

#### SCREW MACHINE PRODUCTS

Galt Machine Screw Co., Galt, Ont.

Knight Metal Products, Ltd., Toronto, Ont.

United Brass & Lead, Ltd., Toronto.

Wentworth Mfg. Co., Hamilton, Ont.

#### SCREW MACHINES, HAND, AUTOMATIC

Brown & Sharpe Mfg. Co., Providence, R.I.

Can. Fairbanks-Morse Co., Montreal.

H. C. Dodge, Inc., Boston, Mass.

Foster Machine Co., Elkhart, Ind.

Garlock-Walker Machy. Co., Ltd., Toronto, Ont.

Garvin Machine Co., New York.

Greenfield Tap & Die Corp., Greenfield, Mass.

A. B. Jardine & Co., Hespeler.

National Acme Co., Cleveland, Ohio.

New Britain Machine Co., New Britain, Conn.

Pratt & Whitney Co., Dundas, Ont.

Wells Bros. of Can., Galt, Ont.

Warner & Swasey Co., Cleveland, O.

A. R. Williams Machy. Co., Toronto.

Wood Turret Mach. Co., Brazil, Ind., U.S.A.

Williams & Wilson, Ltd., Montreal, Que.

#### SCREW MACHINES, AUTOMATIC

#### MULTIPLE SPINDLE

H. C. Dodge, Inc., Boston, Mass.

National Acme Co., Cleveland, Ohio.

New Britain Machine Co., New Britain, Conn.

#### SCREWS

Can. B. K. Morton, Toronto, Montreal.

Galt Machine Screw Co., Galt, Ont.

National Acme Co., Montreal, Que.

Rice Lewis & Son, Toronto, Ont.

Steel Co. of Canada, Ltd., Hamilton, Ont.

United Brass & Lead Ltd., Toronto.

Wilkinson & Kompass, Hamilton, Ont.

#### SCREW PLATES

Butterfield & Co., Rock Island, Que.

Greenfield Tap & Die Corp., Greenfield, Mass.

A. B. Jardine & Co., Hespeler.

Morse Twist Drill & Mch. Co., New Bedford, Mass.

Rice Lewis & Son, Toronto, Ont.

Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

Wells Bros. of Can., Galt, Ont.

Wilkinson & Kompass, Hamilton, Ont.

#### SCREW SLOTTERS

Garvin Machine Co., New York.

National Acme Co., Cleveland, Ohio.

Pratt & Whitney Co., Dundas, Ont.

#### SECOND-HAND MACHINERY

The Geo. F. Foss Mch. & Supply Co., Montreal.

Williams & Wilson, Limited, Montreal, Que.

#### SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR

Pangborn Corporation, Hagerstown, Md.

#### SELF-OPENING DIES

Greenfield Tap & Die Corp., Greenfield, Mass.

Wells Bros. of Can., Galt, Ont.

Williams & Wilson, Limited, Montreal, Que.

#### SEPARATORS, SAND

Pangborn Corporation, Hagerstown, Md.

#### SET SCREWS, SAFETY

Aikenhead Hardware Co., Toronto, Ont.

Allen Mfg. Co., Hartford, Conn.

Bristol Co., Waterbury, Conn., U.S.A.

Wilkinson & Kompass, Hamilton, Ont.



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# DODGE PRODUCTS

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## Turret Lathes

We are manufacturers of a line of Turret Lathes embodying original features which have been tested and not found wanting by *time* and *hard* and *varied* uses.

## The Dodge Features, Etc.

The Dodge features—only in our lathes—minimize floor space—cut out long and superfluous belting—reduce shafting, hangers and pulleys—stimulate the operator—increase production—reduce manufacturing costs.

Our line of lathes, made in several sizes, we recommend to all shops making products from bar stock, castings or forgings. For duplicating work they are unexcelled for quality and quantity production.

Printed matter will be mailed you promptly upon request.

## Screw Machine Products

Under our roof, as a separate department, supervised by its own superintendent, and operated by another force of men, independent of the lathe business, we have two of the largest batteries of screw machines that can be found in any shop. One battery

consists entirely of automatic screw machines, the other is wholly hand-operated turret lathes. With this equipment and organization we are in a particularly good position to manufacture hand and automatic screw machine and metal products *in volume, with precision and on time.*

*Send us samples, prints, sketches, or a rough description of any work you have of this character and we will quote you or have our representative call, if desired.*

# H. C. DODGE, INCORPORATED

**Machinery Manufacturers**  
*Hand and Automatic* **Screw Machine Products**

BOSTON—32 to 46 Alger Street—MASS.

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**SHEARS, PNEUMATIC**

Toledo Machine & Tool Co., Toledo, Ohio.  
**SHEET METAL ROLLING MACHINES**

Peck, Stow & Wilcox Co., Southington, Conn.

**SHEARS, SPLITTING**

Peck, Stow & Wilcox Co., Southington, Conn.

**SHEET METAL MACHINERY**

Peck, Stow & Wilcox Co., Southington, Conn.

**SHEARS, SQUARING**

Brown, Boggs & Co., Hamilton, Canada

Stoll Co., D. H., Buffalo, N.Y.

**SHEET METAL WORKING TOOLS**

Baird Machine Co., Bridgeport, Conn.

Bliss, E. W., Co., Brooklyn, N.Y.

Brown, Boggs & Co., Hamilton, Canada

Peck, Stow & Wilcox Co., Southington, Conn.

Stoll Co., D. H., Buffalo, N.Y.

Williams & Wilson, Limited, Montreal, Que.

**SHEETS, CRUCIBLE, CAST**

Kayser-Ellison & Co., Ltd., Montreal.

Norton, Ralph B., Agent, Montreal.

**STAMPING**

Canadian Cartridge Co., Ltd., Hamilton, Ont.

**SHEET METAL STAMPINGS**

Dominion Forge & Stpg. Co., Walkerville, Ont.

**SHELL BANDING MACHINES, HYDRAULIC**

Garlock-Walker Machy. Co., Ltd., Toronto, Ont.

Metalwood Mfg. Co., Detroit, Mich.

Perrin, Ltd., W. R., Toronto, Ont.

West Tire Setter Co., Rochester, N.Y.

**SHEET METAL WORKING MACHINERY**

Stoll Co., Inc., D. H., Buffalo, N.Y.

**SHELVING, STEEL**

Dennis Wire & Iron Works, London, Ontario

**SHELL PAINTING MACHINES**

Can. Blower & Forge Co., Kitchener, Ont.

Sheldons, Ltd., Galt, Ont.

**SHELL RIVETERS**

Grant Mfg. & Machine Co., Bridgeport, Conn.

High Speed Hammer Co., Rochester, N.Y.

**SHIPBUILDING**

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

**SHOP FURNITURE**

Dennis Wire & Iron Works, London, Ontario

New Britain Mach. Co., New Britain, Conn.

**SIDE TOOLS**

Armstrong Bros. Tool Co., Chicago.

Can. B. K. Morton, Toronto, Montreal.

Williams & Co., J. H., Brooklyn, N.Y.

**SILENT CHAINS**

Can. Link-Belt Co., Toronto, Ont.

Jones & Glasco, Montreal.

**SLEDGES**

Aikenhead Hardware Co., Toronto, Ont.

Rice, Lewis & Son, Toronto, Ont.

Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Whitman & Barnes, Hamilton, Ont.

**SLEDGES, CAST IRON**

Katie Foundry, Galt, Ont.

**SLINGS, CHAIN**

Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

**SLOTTERS**

Betts Machine Co., Rochester, N.Y.

Garvin Machine Co., New York.

National Acme Co., Cleveland, Ohio.

Niles-Bement-Pond Co., New York.

Rhodes Mfg. Co., Hartford, Conn.

**SMOKER'S TOOLS**

Canadian Welding Works, Montreal, Que.

MacKinnon Steel Co., Sherbrooke, Quebec.

Marsh Engineering Works, Belleville, Ont.

**SNIPS, TINNERS AND SHEET METAL WORKERS'**

Kearney & Trecker Co., Milwaukee, Wis.

**ROCKETS**

Brown & Sharpe Mfg. Co., Providence.

Cleveland Twist Drill Co., Cleveland.

Kevstone Mfg. Co., Buffalo, N.Y.

Norden Tool Co., Erie, Pa.

Porter Twist Drill & Mch. Co., New Bedford, Mass.

Rice, Lewis & Son, Toronto, Ont.

**SOCKET HEAD CAP SCREWS**

Allen Mfg. Co., Hartford, Conn.

**SOIL PIPE FITTINGS, CAST IRON**

Katie Foundry, Galt, Ont.

**SOLDERING IRONS**

Aikenhead Hardware Co., Toronto, Ont.

Brown, Roggs & Co., Hamilton, Canada

Pres-O-Lite Co., Inc., Toronto, Ont.

Rice, Lewis & Son, Toronto, Ont.

United Brass & Lead Ltd., Toronto

**SOLDER**

Aikenhead Hardware Co., Toronto, Ont.

Rice, Lewis & Son, Toronto, Ont.

Tallman Brass & Metal Co., Hamilton.

United Brass & Lead, Ltd., Toronto

**SPEED REDUCING GEARS**

Can. Link-Belt Co., Toronto, Ont.

Jones & Glasco, Montreal.

**SPIKES**

Manitoba Bridge & Iron Wks., Ltd., Wpg., Can.

**SPLICING CLAMPS**

Peck, Stow & Wilcox Co., Southington, Conn.

**SPRINGS, MACHINERY**

Barnes, Wallace Co., Bristol, Conn.

Can. Steel Foundries, Ltd., Montreal, Que.

Garvin Machine Co., New York.

Goosey & Edmund, Inc., Courland, N.Y.

John H. Hall & Sons, Brantford.

Hydraulic Machy. Co., Ltd., Montreal, Que.

A. B. Jardine & Co., Hespeler, Ont.

Katie Foundry, Galt, Ont.

National Acme Co., Cleveland, Ohio.

Mulliner & Edmund Tool Co., Syracuse, N.Y.

Marten Machine Co., Hamilton, Ont.

Reed-Prentice Co., Worcester, Mass.

Sleeper & Hartley, Inc., Worcester, Mass.

Stoll Co., D. H., Buffalo, N.Y.

Victoria Foundry Co., Ottawa, Ont.

Welland Motor & Machine Co., Welland, Ont.

Wilson & Co., J. C., Belleville, Ont.

William R. Perrin, Ltd., Toronto.

Windsor Mach. & Tool Co., Windsor, Ont.

**SPRING COILING AND WINDING MACHINERY**

Baird Machine Co., Bridgeport, Conn.

Garvin Machine Co., New York.

Sleeper & Hartley, Inc., Worcester, Mass.

**SPRING MAKING MACHINERY (AUTOMATIC)**

Baird Machine Co., Bridgeport, Conn.

Sleeper & Hartley, Inc., Worcester, Mass.

**SPROCKETS, CHAIN**

Can. Link-Belt Co., Toronto, Ont.

Grant Gear Works, Boston, Mass.

Jones & Glasco, Montreal.

Morse Chain Co., Ithaca, N.Y.

Philadelphia Gear Works, Philadelphia, Pa.

Wilson & Co., J. C., Belleville, Ont.

**SPROCKET WHEELS, CAST**

Can. Link-Belt Co., Toronto, Ont.

Perrin, Wm. R., Toronto.

Wilson & Co., J. C., Belleville, Ont.

**SPROCKET WHEELS, CHILLED THREAD**

Katie Foundry, Galt, Ont.

**SQUARES**

Peck, Stow & Wilcox Co., Southington, Conn.

**STAYBOLT TOPS**

Greenfield Tap & Die Corp., Greenfield, Mass.

Wells Bros. of Can., Galt, Ont.

**STAIRS, IRON**

Can. Welding Works, Montreal, Que.

Canada Wire & Iron Goods Co., Hamilton, Ont.

**STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL**

Dora, Forge & Stamping Co., Walkerville, Ont.

Home & Wilson, Hamilton, Ont.

Wentworth Mfg. Co., Hamilton, Ont.

**STAMPINGS, METAL**

American Pulley Co., Philadelphia, Pa.

**STAMPING MACHINERY**

Bliss Co., E. W., Brooklyn, N.Y.

Brown, Roggs & Co., Hamilton, Canada

Canada Machinery Corp., Galt, Ont.

Parraute Mach. Co., Bridgton, N.J.

**STAMPS, STEEL ALPHABET, FIGURES**

Mathews, Jas. H. & Co., Hartford, Conn.

Pritchard-Andrews Co., Ottawa, Can.

**STAPLE MACHINES**

Blower & Hartley, Inc., Worcester, Mass.

**STEAM APPLIANCES**

Darling Bros. Ltd., Montreal, Quebec

**STEAM SEPARATORS AND TRAPS**

Can. Fairbanks-Morse Co., Montreal.

Thelms, Ltd., Galt, Ont.

**STEEL BALLS**

Rochester Ball Bearing Co., Rochester, N.Y.

**STEEL, CRUCIBLE TOOL**

Hammond Steel Co., Inc., Syracuse, N.Y.

Wilmington Steel Co., John, New York, N.Y.

Kayser-Ellison & Co., Ltd., Montreal.

Norton, Ralph B., Agent, Montreal.

Vulcan Crucible Steel Co., Aliquippa, Pa.

**STEEL, CARRON, FERRO-TUNGSTEN**

Armstrong Whitworth of Canada, Montreal, Que.

Baker & Co., Inc., Montreal, Que.

Can. B. K. Morton, Toronto, Montreal.

Smith & Sons, Montreal, Que.

Kayser-Ellison & Co., Ltd., Montreal.

Norton, Ralph B., Agent, Montreal.

Latrobe Electric Steel Co., Latrobe, Pa.

Vanadium-Alloys Steel Co., Pittsburgh, Pa.

Vulcan Crucible Steel Co., Aliquippa, Pa.

**STEEL, CASTINGS**

Joliet Steel Co., Montreal, Que.

Kennedy & Sons, Wm., Owen Sound, Ont.

Can. Brakeshoe Co., Sherbrooke, Que.

Nova Scotia Steel & Coal Co., New Glasgow, N.S.

Swedish Crucible Steel Co., Windsor, Ont.

**STEEL, COLD ROLLED**

Can. Drawn Steel Co., Hamilton, Ont.

Kayser-Ellison & Co., Ltd., Montreal.

Norton, Ralph B., Agent, Montreal.

Rice, Lewis & Son, Toronto, Ont.

Swedish Steel & Importing Co., Ltd., Montreal.

Union Drawn Steel Co., Hamilton, Ont.

**STEEL PRESSURE BLOWERS**

Can. Blower & Forge Co., Kitchener, Ont.

Can. Fairbanks-Morse Co., Montreal.

Thelms, Ltd., Galt, Ont.

**STEEL, NICKEL**

Firth & Sons, Thos., Montreal, Que.

Kayser-Ellison & Co., Ltd., Montreal.

Norton, Ralph B., Agent, Montreal.

Vulcan Crucible Steel Co., Aliquippa, Pa.

**STEEL, HIGH SPEED**

Armstrong Whitworth of Canada, Ltd., Montreal.

Atkins & Co., Wm., Sheffield, Eng.

Baker & Co., Inc., H., Montreal, Que.

Can. Fairbanks-Morse Co., Montreal.

Can. B. K. Morton, Toronto, Montreal.

H. A. Drury Co., Ltd., Toronto.

Marshall & Co., Geo., Toronto, Ont.

Firth & Sons, Thos., Montreal, Que.

Hawbridge Bros. Co., Boston, Mass.

Wilmington Steel Co., John, New York, N.Y.

Latrobe Electric Steel Co., Latrobe, Pa.

Plowess, Ltd., Winnipeg, Man.

Rice, Lewis & Son, Toronto, Ont.

Standard Alloys Company, Pittsburgh, Pa.

Swedish Steel & Importing Co., Ltd., Montreal.

Vanadium-Alloys Steel Co., Pittsburgh, Pa.

Vulcan Crucible Steel Co., Aliquippa, Pa.; represented in Canada by Norton, Callard & Co., Montreal, Que.

**STEEL, GRIT**

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

**STEEL, CHROME AND MANGANESE**

Joliet Steel Co., Montreal, Que.

**STEEL, OPEN HEARTH**

Wilmington Steel Co., John, New York, N.Y.

**STEEL, CRUSHED**

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

**STEEL, ROCK DRILL**

Armstrong, Whitworth of Canada, Montreal, Que.

Kayser-Ellison & Co., Ltd., Montreal.

Norton, Ralph B., Agent, Montreal.

**STEEL, SPECIAL ELECTRIC ALLOY**

Hammond Steel Co., Inc., Syracuse, N.Y.

**STELLITE, HIGH-SPEED TOOL METAL**

Deloro Smelting & Refining Co., Toronto, Ont.

**STEEL, STRUCTURAL**

Algoma Steel Corp., Sault Ste. Marie, Ont.

**STEEL, VANADIUM**

Armstrong, Whitworth of Canada, Montreal, Que.

Drury, H. A., Co., Montreal, Que.

Kayser-Ellison & Co., Ltd., Montreal.

Norton, Ralph B., Agent, Montreal.

Standard Alloys Co., Pittsburgh, Pa.

Vulcan-Alloys Steel Co., Aliquippa, Pa.

Vulcan Crucible Steel Co., Aliquippa, Pa.

**STOCK RACKS FOR BARS, PIPING, ETC.**

Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

New Britain Machine Co., New Britain, Conn.

**STOCKS AND DIES**

Greenfield Tap & Die Corp., Greenfield, Mass.

Wells Bros. of Can., Galt, Ont.

**STOCKS, PIPE**

Butterfield & Co., Rock Island, Que.

A. B. Jardine & Co., Limited, Hespeler, Ont.

Rice, Lewis & Son, Toronto, Ont.

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**TAPES—MEASURING, STEEL AND WOVEN**  
Luffkin Rule Co. of Can., Windsor, Ont.

**TAPES, POCKET**  
Luffkin Rule Co. of Can., Windsor, Ont.

**TAPS, ADJUSTABLE**  
Baxter Co., Ltd., J. R., Montreal, Que.  
Baker & Co., Inc., H., Montreal, Que.  
Butterfield & Co., Rock Island, Que.  
Geometric Tool Co., New Haven.  
Modern Tool Co., Erie, Pa.  
Murphy Machine & Tool Co., Detroit.  
Victor Tool Co., Waynesboro, Pa.

**TAPS, BOILER**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.

**TAPS, GUN**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.

**TAPS, HAND**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.

**TAPS, MACHINE RELIEVED**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.

**TAPS, MACHINE SCREW**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.

**TAPS, PIPE**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.

**TAPS, STAYBOLT, "MAX" TAP**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.

**TAPS, TAPPER**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.

**TAPS, DIES AND WRENCHES**  
Butterfield & Co., Rock Island, Que.  
Can. Fairbanks-Morse Co., Montreal.  
Cleveland Twist Drill Co., Cleveland.  
The Geo. F. Foss Mch. & Supply Co., Montreal.  
Geometric Tool Co., New Haven.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
A. B. Jardine & Co., Hespeler, Ont.  
Landis Machine Co., Waynesboro, Pa.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
Murphy Machine & Tool Co., Detroit.  
Pratt & Whitney Co., Dundas, Ont.  
Rice, Lewis & Son, Toronto, Ont.  
L. S. Starrett Co., Athol, Mass.  
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.  
Wells Bros. Co. of Canada, Galt, Ont.  
Williams & Wilson, Limited, Montreal, Que.

**TAP EXTENSIONS**  
Allen Mfg. Co., Hartford, Conn.

**TAP EXTRACTORS**  
Walton Co., The, Hartford, Conn.

**THERMOMETERS, INDUSTRIAL**  
Taylor Instrument Co., Rochester, N.Y.

**THERMOMETERS, ENGRAVED**  
Taylor Instrument Co., Rochester, N.Y.

**THERMOMETERS, TEMPERATURE AND PRESSURE**  
Taylor Instrument Co., Rochester, N.Y.

**THERMOMETERS, RECORDING AND INDEX**  
Bristol Co., Waterbury, Conn., U.S.A.  
Taylor Instrument Co., Rochester, N.Y.

**TESTING INSTRUMENTS**  
Shore Instrument & Mfg. Co., New York City

**METALLURGICAL**  
Shore Instrument & Mfg. Co., New York City

**TESTING LABORATORIES**  
Toronto Testing Laboratories, Toronto

**THREAD-CUTTING MACHINES**  
Can. Fairbanks-Morse Co., Montreal.  
Curtis & Curtis Co., Bridgeport, Conn.  
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.  
Geometric Tool Co., New Haven.  
A. B. Jardine & Co., Limited, Hespeler, Ont.  
Landis Machine Co., Waynesboro, Pa.  
National-Acme Co., Cleveland, Ohio.  
National Machy. Co., Tiffin, Ohio.  
Pratt & Whitney Co., Dundas, Ont.  
Wells Bros. Co. of Canada, Galt, Ont.  
Williams & Wilson, Limited, Montreal, Que.

**THREADING TOOLS**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Landis Machine Co., Waynesboro, Pa.  
Pratt & Whitney Co., Dundas, Ont.  
Wells Bros. of Can., Galt, Ont.  
Williams & Co., J. H., Brooklyn, N.Y.

**THREADING MACHINES FOR BOLTS, NUTS AND PIPES**  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Wells Bros. of Can., Galt, Ont.  
Williams & Wilson, Limited, Montreal, Que.

**THREAD MILLING MACHINES**  
Taft-Pierce Mfg. Co., New York, N.Y.  
Smalley-General Co., Inc., Bay City, Mich.

**THUMB SCREWS AND NUTS**  
Canada Foundry & Forgings, Ltd., Welland, Ont.  
United Brass & Lead Ltd., Toronto.  
Williams & Co., J. H., Brooklyn, N.Y.

**TENSMITHS' TOOLS**  
Brown, Rogers & Co., Hamilton, Can.  
Williams & Wilson, Limited, Montreal, Que.

**TIRE BENDERS**  
A. B. Jardine & Co., Limited, Hespeler, Ont.

**TIRE SETTING MACHINES, HYDRAULIC**  
William R. Perrin, Ltd., Toronto.  
West Tire Setter Co., Rochester, N.Y.

**TOOL CASES**  
Rice, Lewis & Son, Toronto, Ont.

**TOOL HOLDERS**  
Aikenhead Hardware Co., Toronto, Ont.  
Cleveland Twist Drill Co., Cleveland.

Armstrong Bros. Tool Co., Chicago.  
Deloro Smelting & Refining Co., Toronto, Ont.  
Gisholt Machine Co., Madison, Wis.  
Modern Tool Co., Erie, Pa.  
Pratt & Whitney Co., Dundas, Ont.  
Rice, Lewis & Son, Toronto, Ont.  
Williams & Co., J. H., Brooklyn, N.Y.

**TOOL POSTS, LATHE**  
Armstrong Bros. Tool Co., Chicago.  
Williams & Co., J. H., Brooklyn, N.Y.

**TOOL ROOM PARTITIONS**  
Canada Wire & Iron Goods Co., Hamilton.

**TOOL STEEL**  
Armstrong Whitworth, Ltd. of Canada, Montreal.  
Arkins & Co., Wm., Sheffield, Eng.  
Baker & Co., Inc., H., Montreal, Que.  
Can. Fairbanks-Morse Co., Montreal.  
Deloro Smelting & Refining Co., Toronto, Ont.  
General Steel Co., Milwaukee, Wis.  
H. A. Drury Co., Montreal.

**Firth & Sons, Thos., Montreal, Que.**  
Hammond Steel Co., Inc., Syracuse, N.Y.  
Harvey & Co., Arthur C., Boston, Mass.  
Hawthorne Bros. Co., Boston, Mass.  
Kaiser-Eisen & Co., Ltd., Montreal.  
Norton, Ralph B., Agent, Montreal.

**Latrobe Electric Steel Co., Latrobe, Pa.**  
Marshall & Co., Geo., Toronto, Ont.  
Rice, Lewis & Son, Toronto, Ont.  
Vanadium-Alloys Steel Co., Pittsburgh, Pa.  
Vulcan Crucible Steel Co., Aliquippa, Pa.

**TOOLS, BENDING**  
Peck, Stow & Wilcox Co., Southington, Conn.

**TOOLS, BLACKSMITHS'**  
A. B. Jardine & Co., Limited, Hespeler, Ont.  
Rice, Lewis & Son, Toronto, Ont.

**TOOLS, ADJUSTABLE BORING**  
The Kelly Reamer Co., Cleveland, O.  
Williams & Wilson, Limited, Montreal, Que.

**TOOLS, ELECTRIC**  
Independent Pneumatic Tool Co., Chicago, Ill.  
A. R. Williams Machinery Co., Toronto.  
Ford-Smith Machine Co., Hamilton, Ont.  
United States Elec. Tool Co., Cincinnati, O.

**TOOLS, FORMING**  
Davison Tool Mfg. Co., New York, N.Y.

**TOOLS, PNEUMATIC**  
Curtis Pneumatic Tool Co., Montreal, Que.  
Cleveland Pneumatic Tool Co. of Canada, Toronto.  
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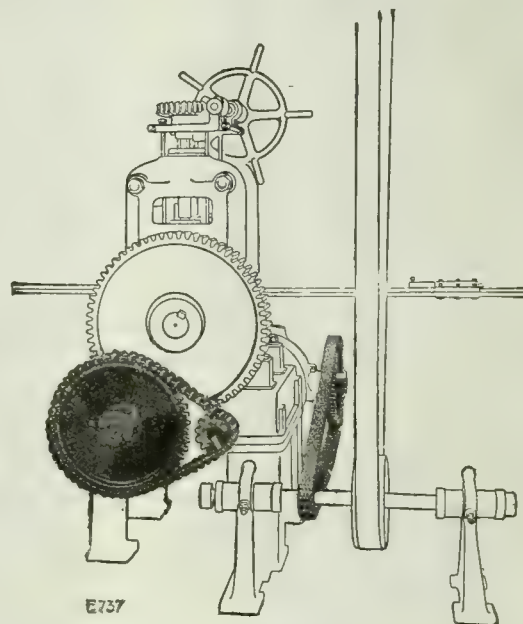
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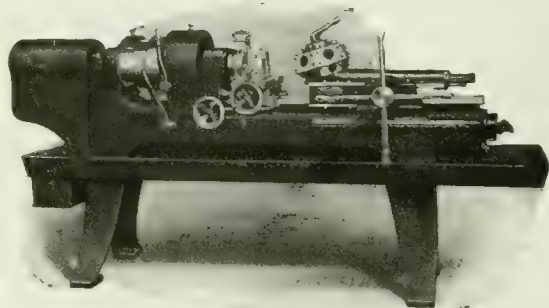
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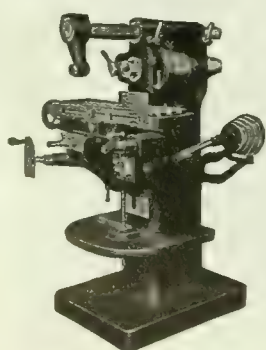


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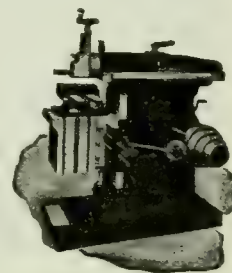


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*A weekly newspaper devoted to the machinery and manufacturing interests.*

Vol. XXI.

TORONTO, MARCH 20, 1919

No. 12

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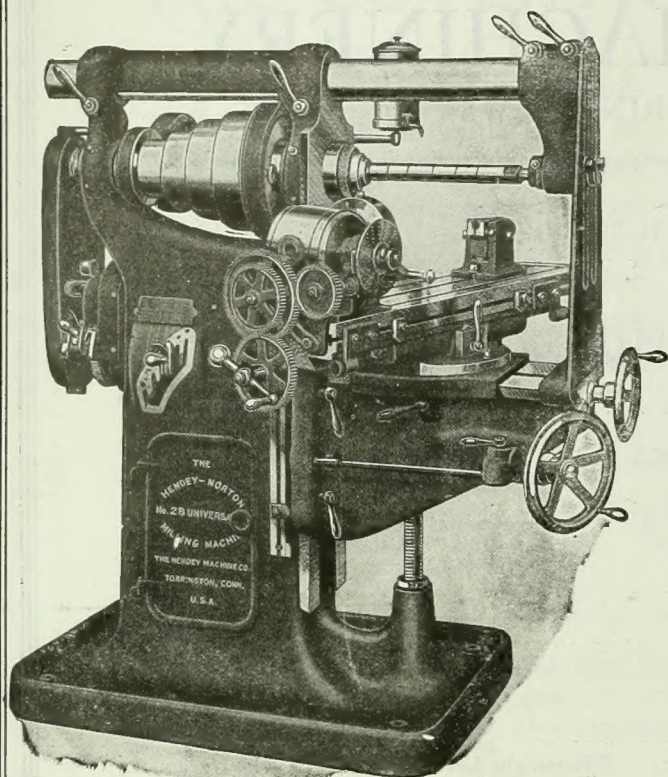
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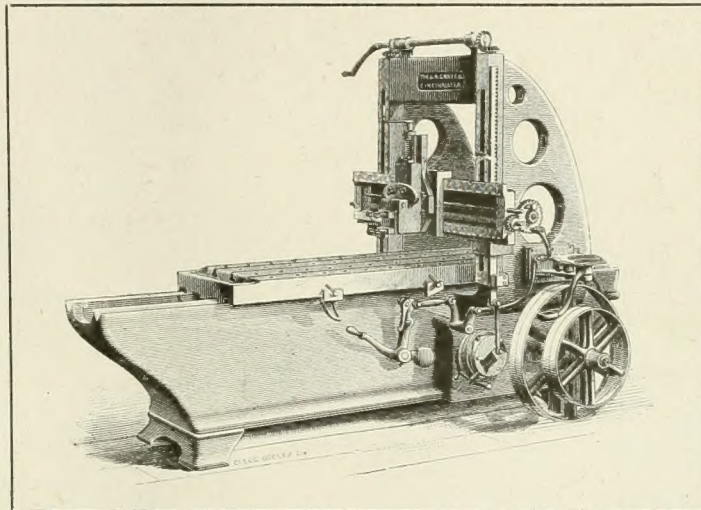
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